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Published Monthly By
THE INDUSTRIAL PRESS
148 Lafayette St., New York 13, N. Y.

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DON HARWAY & COMPANY
1709 W. Eighth St., Los Angeles 17, Calif.

Subscription rates: United States and Canada, one year, $4; two years, $7; three years, $8; foreign countries, one year, $7; two years, $13. Single copies, 40 cents. Changes in address must be received by the fifteenth of the month to be effective for the next issue. Send old as well as new address. Entered as second-class mail matter, September, 1894, at the Post Office, New York, N. Y., under the Act of March 3, 1879. Printed in the United States of America.

British Address:
National House, West St.
Brighton 1, England

Total Distribution for May, 23,925

MACHINERY

VOLUME 57 **JUNE, 1951** NUMBER 10

The Monthly Magazine of Engineering and Production in the Manufacture of Metal Products

SHOP PRACTICE

MACHINE AND TOOL DESIGN

MANAGEMENT PROBLEMS

DEPARTMENTS

By LORING F. OVERMAN

Things are Beginning to Move in Washington

AFTER a long period of delay and uncertainty, things have begun to move in Washington. The long-debated CMP plan has been announced. The manufacturers' pricing order has come out. New defense facilities have been authorized. Another $8,600,000 in pool orders has been placed for machine tools.

Perhaps the tip-off on future developments came on April 24 when NPA asked the Packaging Machinery Advisory Committee to convert members of that industry to the production of machine tools. NPA officials explained that the extensive expansion of the defense program due within the next few months will force an expansion in machine tool production. The packaging machinery industry reported that only 1 per cent of its regular production of packaging machines is going into defense-rated orders, but 10 per cent of the total plant facilities is now devoted to defense work.

In addition to the effort to convert the packaging group to machine tool production, NPA is also studying plans to expedite the flow of used, idle, and reserve machine tools into defense production. The situation was discussed at the industry advisory committee meeting of the Second-Hand Tool Rebuilders. This group reported that there is a backlog of from two to six months in machine rebuilding. The situation cannot be cured by an expansion of facilities because of the shortage of skilled workers. Yet the idle and unused machines must be converted, Navy spokesmen said, because they are rendered obsolete by technological changes.

Industry group members, on the other hand, reported a scarcity of used machine tools and complained that inventories of late models are almost depleted. They asked the Government to release tools for sale in the open market. The industry is also facing difficulties in procuring parts and materials. Some companies said that rebuilt machines for the defense effort lie around for as long as four months waiting for parts from manufacturers.

Regulation 7 of the new Controlled Materials Plan is designed to help repair shops meet such situations, but this will not be effective before July 1. In the meantime, the industry was told to notify NPA if DO-97 ratings for maintenance, repair, and operating supplies are not honored. The industry was also told that it could use a DO-98 rating, covering production equipment for private contractors, to obtain necessary parts and materials. This rating can be used, however, only when tools are being rebuilt for defense contractors.

In a further effort to break the growing bottleneck, screw machine manufacturers have been asked to pool their inventories, so that manufacturers whose working supplies are nearly depleted could obtain metals. This request was made by NPA officials at a closed meeting with the Screw Machinery Industry Advisory Committee. The pool would be accomplished by transferring metals from companies having large reserves to those whose working stocks are nearly gone. NPA warned manufacturers to take prompt action if there was any evidence of violation of inventory regulations.

In discussing the situation, the industry reported: (1) Inventories are unbalanced. (2) There is a growing backlog of orders, including DO orders. (3) Skilled manpower is becoming scarce, particularly in the Chicago area. (4) Repair parts are difficult to obtain and the industry's permitted quota for MRO is insufficient to keep plants running and in good condition under present stepped-up production schedules.

A major difficulty, it was asserted, lies in the inability to obtain brass mill products. NPA agreed with a committee recommendation that raw material consigned to a brass mill be charged to the customer's inventory rather than to the inventory of the mill. Steel production, the group was told, would be increased during the second half of the year to a point compensating for enlarged military demand. NPA promised the industry help in obtaining steel when the Controlled Materials Plan becomes effective. It was pointed out that materials allocation tickets could then be cashed without difficulty, whereas many small producers are now unable to compete in the free market for steel.

Growing difficulties like those outlined hastened NPA's decision to announce that a full-fledged Controlled Materials Plan similar to that of World War II will become effective July 1. The program will provide for the allocation of steel, copper, and aluminum. Prospective users of those materials must submit detailed requirements in advance of July 1.

The general idea of putting CMP into effect is that when the water is taken out of existing programs, it may be found that there is more material instead of less available for consumers. NPA officials are of the opinion that military purchasing agents, in their anxiety to avoid getting caught short, have overestimated requirements. By being required to program future uses by quarters, and to turn back for reallocation amounts not used, it is expected that sources will loosen up.

Orders for an additional $8,600,000 worth of machine tools for defense industries were announced by the General Services Administration on April 20. The total amount of such orders is now $87,000,000. GSA serves as the clearing house for machine tools, placing orders with manufacturers and reselling the tools to defense production industries.

Orders announced and their values are: Hydraulic Press Mfg. Co., Mount Gilead, Ohio, $689,340; Denison Engineering Co., Columbus, Ohio, $879,599; E. W. Bliss Co., Canton, Ohio, $3,155,420; Clearing Machinery Corporation, Chicago, Ill., $1,539,493; American Steel Foundries, Cincinnati, Ohio, $865,680; and Bardons & Oliver, Cleveland, Ohio, $1,525,017.

Expansion of facilities also came in for attention in April. Certificates of Necessity to encourage construction of 396 new or expanded defense facilities costing an estimated $1,300,000,000 were issued by the Defense Production Administration. The list contains the names of several manufacturers of machine tools, as well as those who will be users of machinery in the months to come. Copies are available from Defense Production Administration, Washington 25, D. C., (Press Release DPA-19).

Why Machine Tools May be a Bottleneck

GENERAL MacArthur's triumphant return to his native land and defense of his actions as Supreme Commander in the Far East served to emphasize the hit-or-miss policies followed by our Government in world affairs. But there is also confusion on the defense production front. Industry has been more than willing to get the production ball rolling, but the indecision and dilatory attitude of Government officials have impeded progress.

Manufacturers who agreed to definite production rates by specific dates are generally unable to fulfill their commitments, because they cannot immediately obtain the new machine tools required. Why is there a hold-up of new machines? The principal reason is that months ago persons high in the National Production Authority and other Government circles found it hard to understand that machine tools are literally the foundation of national defense. All guns, ammunition, ships, aircraft, and even the equipment required in the preparation of raw materials can be produced only by machine tools.

Machine tool builders realized when the Korean War broke out that they would have to expand drastically in order to meet the needs of a satisfactory defense program. This made it imperative that the industry should be given a blanket priority on materials, the same as in the early stages of World War II, so that production could be speeded up. However, the machine tool industry was placed on a parity with producers of civilian goods. DO orders on machine tools were restricted to machines that might be a bottleneck in the munitions program. Many machines are being held up on assembly floors by inability to obtain certain items.

The limitation has been removed for certain conditions, but the only solution to the current machine tool materials problem is to give the industry a blanket priority for all material needs. Because this has not been done, the production of the industry has been practically constant since last September. In the meantime, the backlog has crept up from eight months to twenty-two months.

There are other factors retarding expanded production in the machine tool industry, of which price control and the scarcity of skilled labor are perhaps the most serious. The maximum price that can be charged for a machine tool is the price at which it was "delivered" in the base period between December 19 and January 25 last. As machine tool prices are necessarily quoted months before shipment, quotations for many of the machine tools shipped in January were based on prices as much as three years old. In the meantime, costs had risen tremendously. A machine tool builder is asked, therefore, to quote on machines to be delivered months afterward, with the certainty that he will lose money, because to the basic prices he can add only certain elements of cost. The Government wants manufacturers to exert every effort toward early delivery of machine tools, but over-time and extra pay for night shifts cannot be figured into prices. Unprofitable manufacturing operations obviously cannot long be continued!

These facts concerning the industry can be cited as a defense against the recurring charge that machine tools are the bottleneck in rearming the nation. The output of the machine tool industry in 1951 will actually be less than one-third the output in 1941. Whose fault is it?

Charles O. Herb
EDITOR

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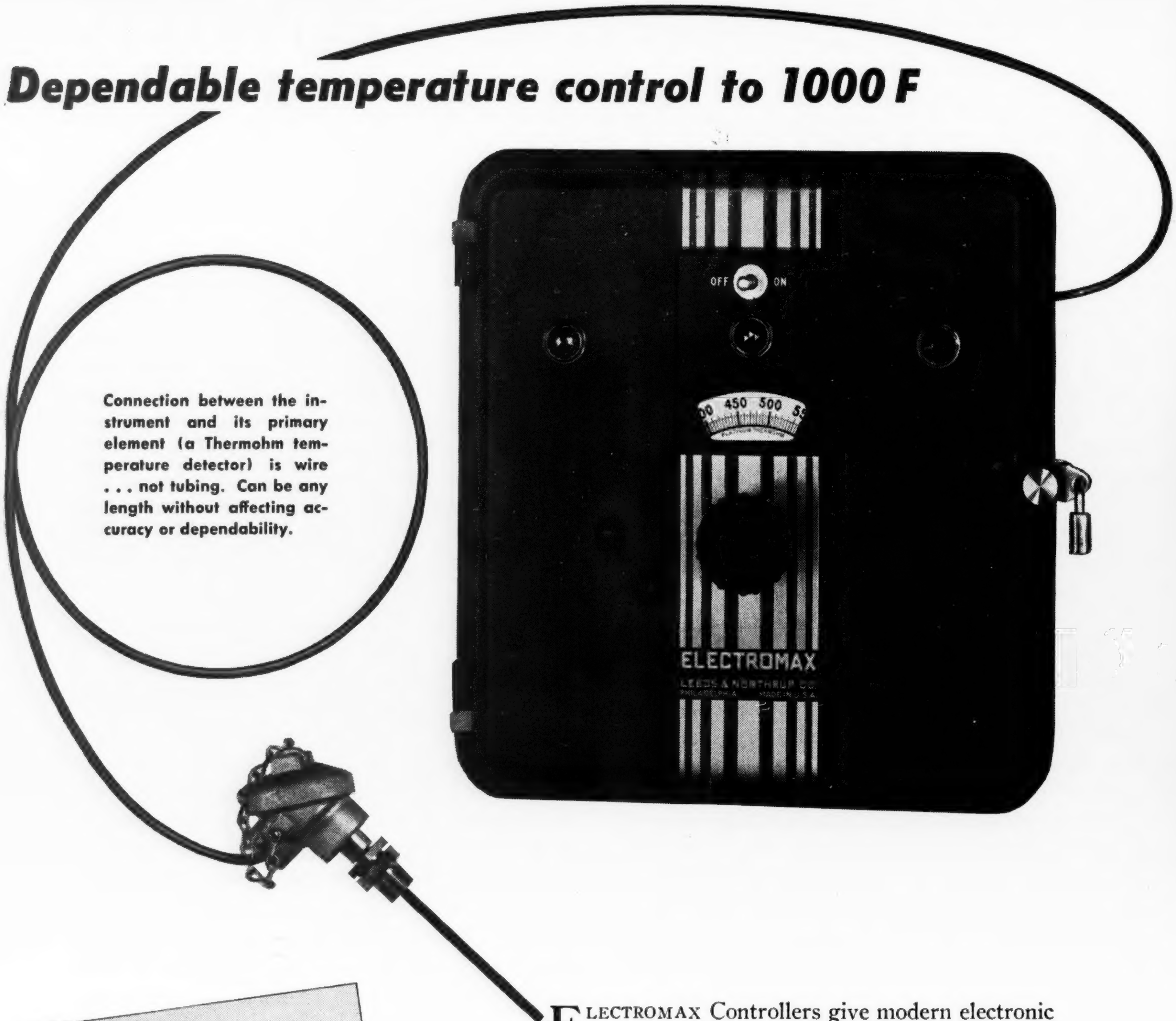

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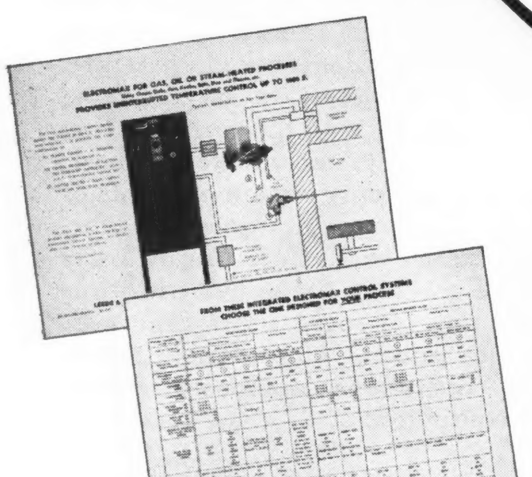

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Vol. 57 No. 10 MACHINERY JUNE, 1951

Operating a 75-millimeter recoilless rifle somewhere in North Korea. U. S. Army photo.

Manufacturing Recoilless Rifles for Greater Infantry Fire Power

By CHARLES H. WICK

PORTABLE 57- and 75-millimeter recoilless rifles have greatly increased the fire power of our infantry on the Korean battlefront. Weighing only 45 pounds, the 57-millimeter rifle can easily be fired from the shoulder. This rifle is particularly effective against enemy troops and jeeps, trucks, or other vehicles not equipped with armor. Its maximum range is about 3 miles.

The 75-millimeter recoilless rifle has a weight of 115 pounds, and, as a rule, is mounted on a tripod or vehicle for firing. The larger rifle has a maximum range of approximately 4 1/2 miles, and is used against tanks or other armored vehicles. The degree to which recoil has been eliminated in such large rifles is an outstanding engineering development.

The barrel assembly of these rifles consists of a seamless steel tube screwed to a forged firing chamber. Threaded into the bore at the rear end of the chamber is a Venturi assembly through which the exhaust gases pass. This assembly consists of a breech-block and bushing, which are screwed together prior to machining the close-tolerance slots or exhaust ports.

The Firestone Tire & Rubber Co., one of the largest producers of the Bofors 40-millimeter anti-aircraft gun and other ordnance equipment during World War II, is one of the plants engaged in making the portable recoilless rifles.

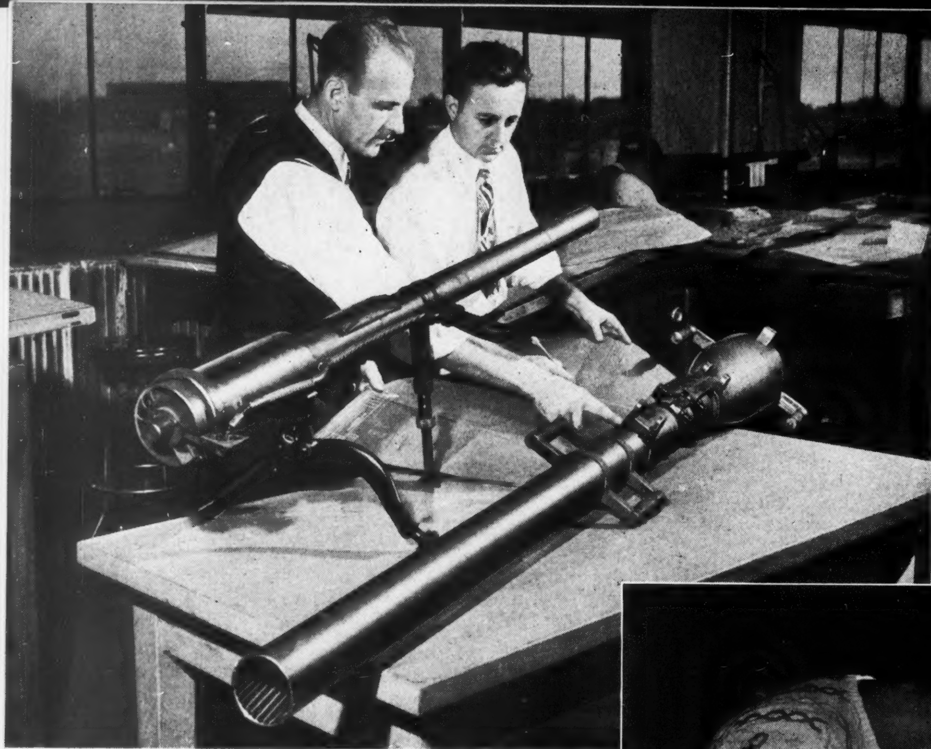


Fig. 1. A 57-millimeter recoilless rifle is shown mounted on a bipod, while a 75-millimeter rifle is lying on the table

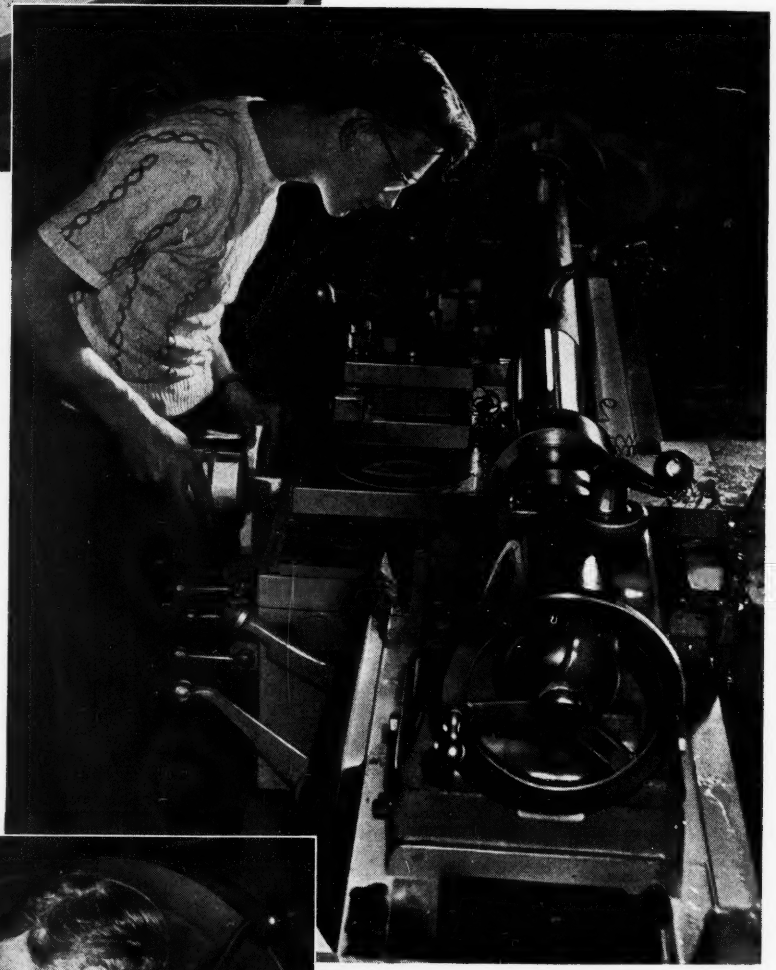


Fig. 2. Set-up employed to turn the tubes for recoilless rifles. Shoulders are machined on both the muzzle and breech ends of the tube

Fig. 3. Rifle tubes are rough- and finish-bored on a horizontal gun boring machine. Babbitt metal "packs" guide the cutting tools through the long bore

Manufacturing practices of that concern are described in this article. For the most part, the procedure described is that followed on 75-millimeter rifles, as this differs but slightly from that employed on the 57-millimeter gun.

The tubes, which are subsequently threaded to the chambers to form the barrel assemblies for the recoilless rifles, are made from gun steel. Formerly these parts were machined from forgings, but hot-rolled seamless steel tubes are now employed. Tubing for the 75-millimeter rifle as supplied from the steel mill has an outside diameter of 3.906 inches and is cut into 66-inch lengths. The 57-millimeter tubes have a diameter of 2 15/16 inches, and are cut into 50-inch lengths.

A 75-millimeter tube is shown being rough-turned on a Monarch 16-inch lathe in Fig. 2. The tube is lifted into the machine by means of an overhead electric hoist. Universal three-jaw chucks grip the bore at both ends of the tube. In the first cut, a single-point carbide tool rough-turns the periphery of the tube. Shoulders are then turned on the muzzle and breech ends. The tube is then taper-turned for about one-half the distance between these two shoulders.

After the ends have been faced and chamfered, the tube is rough- and semi-finish-bored on the LeBlond horizontal gun boring machine seen in Fig. 3. The tube is chucked through the hollow spindle of the machine, its breech end being held by a three-jaw chuck and a four-roll steadyrest. Push-boring is done from the muzzle end.

Two carbide bits are mounted at the front end of a flat steel bar, 13 1/2 inches long, which is attached to the round shank of the boring-bar. Babbitt metal is poured around the flat steel bar, in a mold, and the assembly is turned to the diameter to be bored. The turned assembly, which is called a "pack" or "guide," is bolted to the shank of the boring-bar. These babbitt packs insure firm support of the cutting bits, preventing chatter and permitting the bore to be machined straight and true.

The boring-bar is piloted by means of a bushing and sliding steadyrest. The carbide bits are ground and held in the boring-bar so that the chips are directed in front of the advancing bar and come out the muzzle end of the tube. In this way, there is no danger of chips lodging between the babbitt packs and the bored surface of the tube. Coolant is applied through the hollow boring-bar to flush the chips out of the bore ahead of the bar. After about 3/16 inch of stock has been removed from the bore diameter in roughing, a finish-boring bar and finish pack are substituted, and 1/8 inch more of stock is removed. Two cuts are obtained from each pack.

Fig. 4. About 0.015 inch of stock is removed from the bore diameter of the rifle tube in a rough- and finish-honing cycle

Both ends of the tube are turned for a short distance to provide for holding the part in the honing fixture. Also, a hole, 3/8 inch in diameter, is drilled in the muzzle end for a pin that prevents the tube from rotating during the honing operation. The tubes are rough- and finish-honed on large horizontal, hydraulically reciprocated honing machines built by the Barnes Drill Co., one of which is seen in Fig. 4. Two steadyrests are employed to hold the tube stationary while the honing head holding the abrasive stones is reciprocated through the bore.

The rifling grooves are produced by broaching on the LeBlond horizontal gun rifling machine shown in Fig. 5. Mounted on the front end of a long tool-bar, the high-speed steel broach is slowly rotated as it is pushed through the bore of the tube hydraulically. Forty-five passes are required to complete each rifle-tube, the cutting tool being changed after each pass. A box containing the other forty-four broaching tools can be seen at the upper left.

Each broach removes from 0.0005 to 0.001 inch of stock in a single pass through the full length of the tube bore. The grooves are broached from the breech end of the tube (which is held in the headstock of the machine) to the

Fig. 5. Forty-five broaches are progressively used to complete the twenty-eight helical rifling grooves in the bore of the 75-millimeter rifle tube

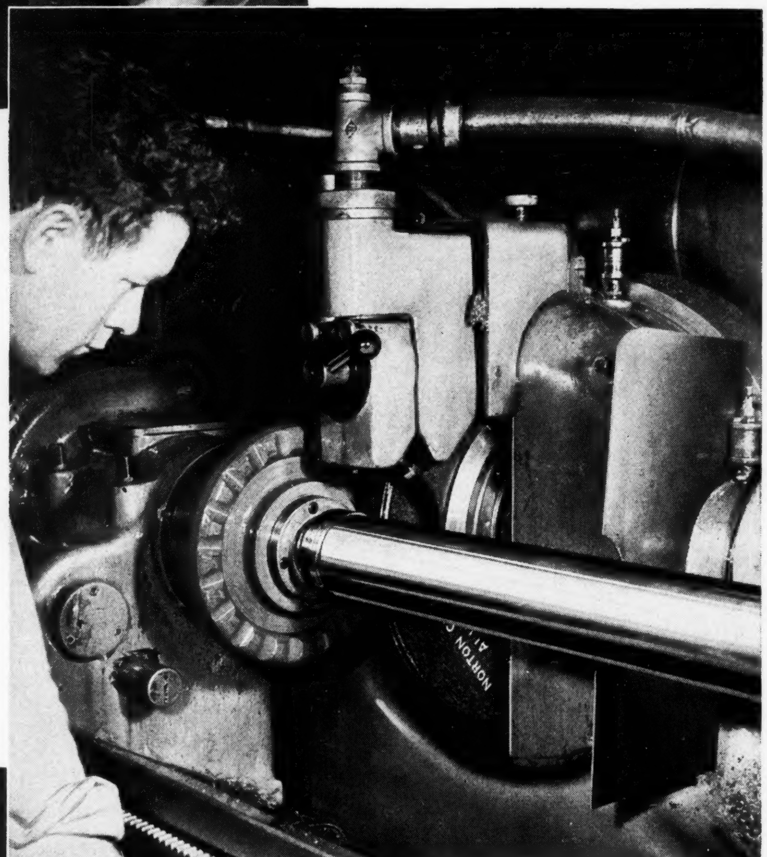


Fig. 6. External threads are ground from the solid on the breech end of the rifle tube for attaching it to the firing chamber forging

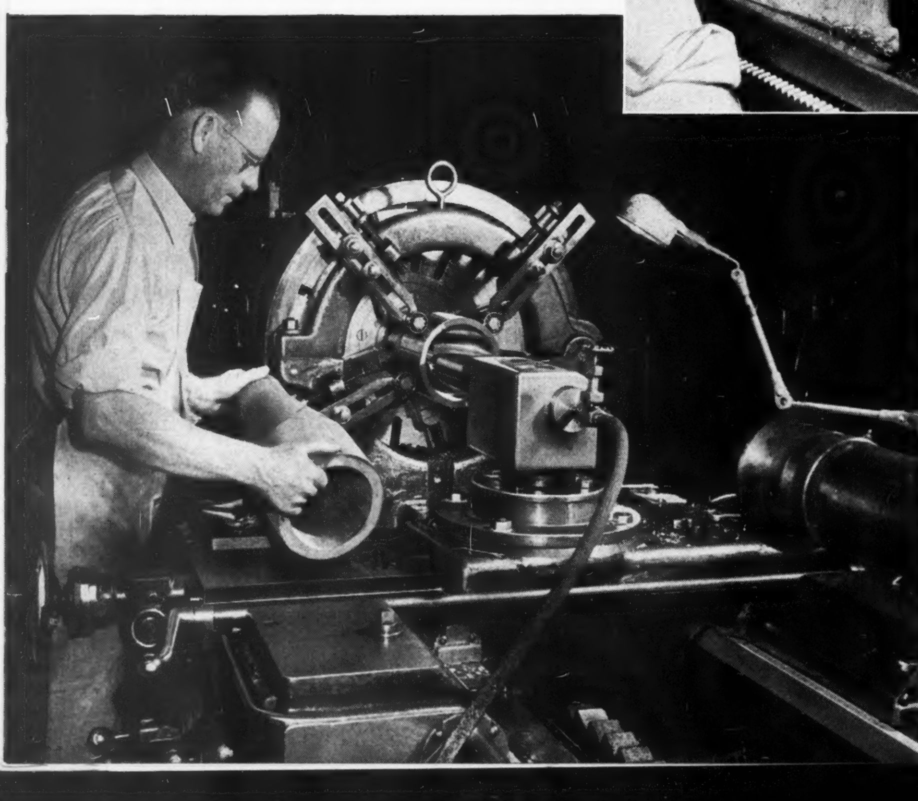


Fig. 7. Boring the forged-steel firing chamber of the 75-millimeter recoilless rifle. The chamber is faced, turned, and chamfered in the same set-up

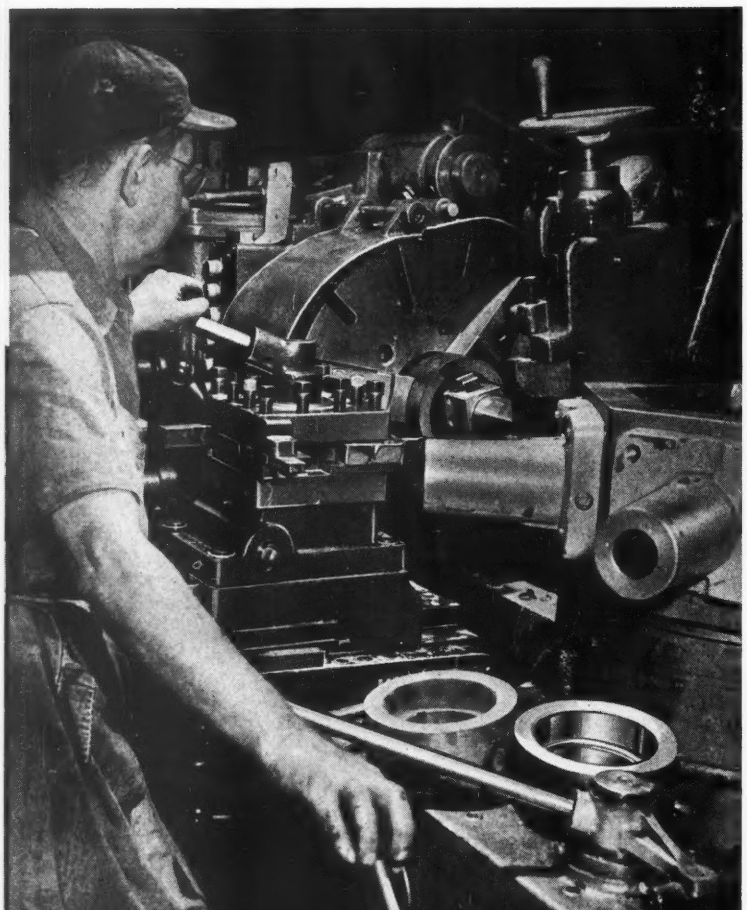
Fig. 8. Straight and tapered surfaces on periphery of the forged firing chamber are finish-turned in this set-up. Taper attachment is seen at rear of lathe

Fig. 9. Both the large- and small-diameter ends of the chamber are internally milled and threaded on the thread milling machine here shown

Fig. 10. Unthreaded internal surfaces of the firing chamber for the recoilless rifles are finish-ground with the work set up as illustrated

Fig. 11. Tubes for 57-millimeter rifles being removed from a hot alkali washing solution prior to applying a phosphate coating

Fig. 12. Boring and facing a bushing that is subsequently screwed to the breech-block to form the Venturi of the recoilless rifle



muzzle end (which is secured in a pivoted, swing type clamping fixture). Coolant is supplied to the cutting tools through the hollow tool-bar. When the broaches wear, the first-pass broach is discarded, a new cutter is supplied for the forty-fifth pass, and each of the other tools is advanced one step in the progression.

The hole drilled in one end of the tube for holding it during honing is cut away when the tube is faced to the required length. External threads are then ground from the solid on the breech end, so that the tube can be joined to the firing chamber forging. A 3 3/4-inch, Class 3 fit, National Standard thread, having eight threads per inch, is ground on the tube by means of the universal automatic thread grinding machine illustrated in Fig. 6.

The breech end of the tube is held in an expanding headstock center, while the opposite end is supported by a steadyrest (not shown). A 60-grit, Grade R, resinoid-bond aluminum-oxide abrasive wheel is employed, and the thread is ground in two cuts. The faces of the wheels are automatically dressed by means of diamonds. When the wheel has been advanced to a pre-set position, the work is traversed past it. The rate of work traverse is controlled by change-gears. Surface speed of the grinding wheel is maintained at about 7500 feet per minute, while the work is rotated slowly at 6 feet per minute.

The firing chamber for the 75-millimeter recoilless rifle is a forging about 16 1/2 inches long and 7 5/8 inches in diameter at its large end. It is bored, faced, chamfered, and partially turned on a Monarch 30-inch engine lathe. With the small-diameter end of the chamber held by means of a four-jaw independent chuck, and the large-diameter end supported on an anti-friction

tailstock center, the work is turned and faced. Following these operations, the tailstock is withdrawn, and an anti-friction steadyrest, as shown in Fig. 7, is used to support the forging from the turned periphery while taper-boring with the taper attachment of the lathe. From 1/8 to 1/4 inch of stock is removed from the various surfaces of the forged chamber in this operation, leaving a minimum amount of stock for final finishing.

The chamber is then transferred to the Monarch 20-inch engine lathe shown in Fig. 8. Here the work is gripped on its previously turned large-diameter end, and the small-diameter end and tapered surface are turned. The 12-degree taper is produced by the taper attachment seen at the rear of the lathe.

Both ends of the forged chamber are internally milled and threaded on the Smalley General thread milling machine illustrated in Fig. 9. The bore in the large-diameter end of the chamber is form-milled, and a recess is formed by the same cutter. A hob is then substituted for the milling cutter, and a non-standard internal thread is machined in the large-diameter end of the chamber. The hob is fed to depth, and then makes one revolution during the cutting cycle.

Next the position of the chamber is reversed, the large-diameter end being mounted on the headstock faceplate, and the pivoted, swing type clamping fixture being provided with a bushing to fit the small-diameter end of the chamber. The bore in the small-diameter end is form-milled, and a recess is milled at the bottom of the bore. A hob is then employed to produce an internal thread.

Unthreaded internal surfaces of the firing chamber are now ground. These include the tapered portion of the chamber, a flat surface, and a concave surface. It is essential that these surfaces be smooth to prevent erosion from the explosion of the propellant charge. This is accomplished on a Bryant internal grinding machine (Fig. 10).

The outer surfaces of the barrel assembly are phosphate-coated to increase their corrosion resistance. Rubber plugs are inserted in the muzzle ends of the tubes, and shields are threaded into the breech ends of the chambers to prevent the bores of the tubes and the internal surfaces of the firing chambers from becoming phosphate-coated. The parts, suspended from racks, are first cleaned by dipping in an alkali washing solution. This bath, made up of 70 pounds of Parco cleaner to 400 gallons of water, is maintained at a temperature of 200 degrees F. The parts remain in the alkali wash for thirty minutes. Tubes for the 57-millimeter

Fig. 13. Set-up employed on a vertical milling machine for finishing the contoured slots in the Venturi of recoilless rifles

recoilless rifle are shown in Fig. 11 being removed from the bath.

After being rinsed in hot water, the parts are immersed in an acid phosphate solution for forty minutes. This bath, containing 16 gallons of Parco compound (consisting essentially of zinc and phosphoric and nitric acids) to 400 gallons of water, is also maintained at a temperature of 200 degrees F. The phosphate-coated tubes are rinsed with cold water, and then immersed for one minute in a hot solution containing 2 quarts of chromic acid to 400 gallons of water. This treatment sets the anti-corrosion coating, after which the parts are dried in air and oiled.

Bushings that are subsequently screwed to the breech-blocks to form the Venturis for the recoilless rifles are turned, bored, faced, and chamfered on the Gisholt turret lathe seen in Fig. 12. After the performance of surface-grinding, precision-boring, finish-turning, external thread-grinding, and internal thread-milling operations on the bushing, the four Venturi slots are rough-milled. The bushing is then assembled to its mating breech-block by screwing them together. Four contoured slots through which the exhaust gases escape from the firing chamber of the rifle are next finished on a Brown &

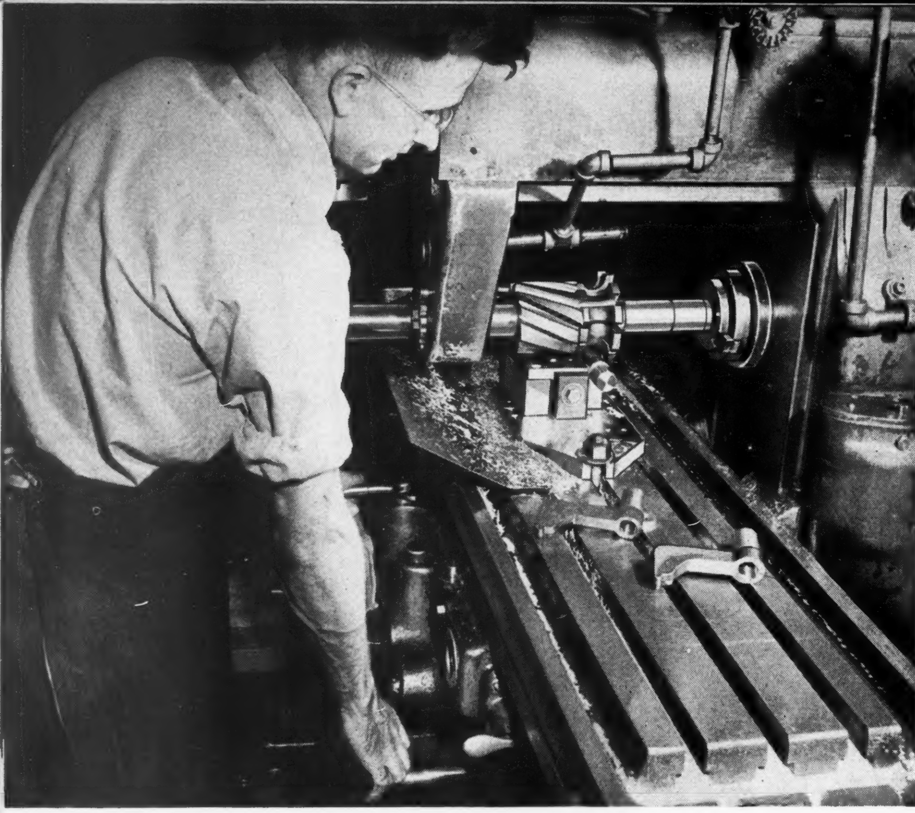


Fig. 14. Both sides of the forged steel carrier brackets for recoilless rifles are form-milled by means of two interlocked cutters

Sharpe No. 2 vertical milling machine (Fig. 13). Both roughing and finishing end-mills, 1/2 inch in diameter, are employed for this operation. During finishing, a hand feed is employed.

Carrier brackets, which are fastened to the breech-block and hinged on the firing chamber bracket of the recoilless rifles, are form-milled with the set-up illustrated in Fig. 14. A plain, helical milling cutter, interlocked with an integral-tooth profile milling cutter, is mounted on the arbor of a Cincinnati horizontal milling machine. Two of the forged steel brackets are held in a fixture on the table of the machine. As the table passes below the cutters, one side and about half the periphery of the lug on each forging are milled. The position of the parts in the fixture is then reversed, and the surfaces on the opposite side of the forgings milled in the next pass. About 1/16 inch of stock is removed per side.

Final inspection of completed 57-millimeter recoilless rifles is shown in Fig. 15. The U. S. Army Ordnance inspectors carefully examine the construction, workmanship, and materials, both inside and out. Dummy shells, such as the one seen in the inspector's hands at the left, are employed to check for specified firing-pin protrusion and for mechanical extraction of the empty cartridge case. The inspector in the center is using a star gage to measure the lands and grooves of the rifling inside the barrel, while the inspector at the right is using a borescope to examine the inside of the barrel for defects.

Fig. 15. Final inspection of completed 57-millimeter recoilless rifles. Dummy shells are employed to check firing-pin protrusion and mechanical extraction of shells

Precision Machining of Studebaker Automatic Transmission Parts

Unusual Tooling Used at Borg-Warner Detroit Gear Division to Manufacture Highly Accurate Parts for Studebaker's New Automatic Transmission at Mass Production Rates

STUDEBAKER'S new automatic transmission is a joint development of Borg-Warner and Studebaker engineers. The transmission—one of the simplest thus far developed—consists essentially of a single-stage hydraulic torque converter, a planetary gear system, and a hydraulic control system. A direct-drive clutch, which connects the engine directly to the rear axle of the car, is automatically engaged when the car reaches a speed of over eighteen miles per hour—the exact speed depending on the position of the throttle. Creep of the automobile while the engine is idling has been eliminated.

A high degree of accuracy is required on many of the parts employed in this automatic transmission. Some of the more unusual processes and tools developed to produce these parts on a mass production basis, with resulting decreased costs, will be described in this article.

Blanks for the rear planet pinion of the automatic transmission are produced from S A E 8620-H cold-drawn steel bars on Conomatic six-spindle automatics. In this operation, the blanks are bored to a diameter of 0.532 inch, with a tolerance of $\pm$ 0.001 inch. The blanks, which are approximately 1 1/16 inches long, are then finish-bored, faced, and chamfered on the Ex-Cell-O single-end, two-spindle precision boring machine seen in Fig. 1.

From 0.006 to 0.007 inch of stock is removed

Fig. 1. Rear planet pinion blanks for the automatic transmission are finish-bored, faced, and chamfered two at a time, at the rate of 112 per hour

Fig. 2. Gear-shaving machine provided with magazine feed and automatic ejection means gives a production of 129 pinions per hour

per side in one pass in this operation. The bore of the pinion blank is held to a diameter of from 0.5458 to 0.5463 inch—a total tolerance of only 0.0005 inch. Also, the bore is maintained round within 0.0002 inch, and the taper of the bore must not exceed 0.0003 inch. Simultaneously, tools on the cross-slide of the machine face the blank to a length of from 1.0565 to 1.0590 inch. The face must be held square with the bore to 0.0003 inch total indicator reading. A Pratt & Whitney Air-O-Limit pneumatic gage is used to inspect the bore.

The work is held in the precision boring machine by means of Woodworth air-operated, diaphragm arbor chucks, and is rotated at 3000 R.P.M., resulting in a cutting speed of 510 feet per minute. The boring, facing, and chamfering tools are Carboloy Grade 831 or Kennametal K4H carbide. They are fed at the rate of 3.6 inches per minute, or about 0.0012 inch per revolution. Although the actual cutting time is only 19.2 seconds, the entire cycle, including chucking, unloading, tool replacements, etc., requires 31.8 seconds. Since two blanks are completed per cycle, a total production of 112 per hour is obtained.

After 19 helical teeth (of 16 diametral pitch, 20 degrees pressure angle, and 1.2637 inches pitch diameter) have been hobbed on the rear planet pinion blanks, the teeth are crown-shaved by means of the set-up shown in Fig. 2. In this operation, performed on a Michigan rotary gear-shaver, from 0.0015 to 0.0035 inch of stock is cut from the working surfaces of the teeth to provide greater accuracy and obtain an improved surface finish. A crown of from 0.0006 to 0.0010 inch per side is provided, and the maximum allowable lead variation is $\pm$ 0.0003 inch. When measured over 0.125-inch diameter balls, the hobbed pinion is between 1.511 and 1.513 inches, and the shaved pinion between 1.506 and 1.508 inches.

With magazine feed and means for automatically ejecting the shaved pinions, one man can easily take care of two machines. The time required for the cycle is 27.6 seconds, giving a production of 129 pinions per hour on each machine, or a total of 258 pinions per hour. The operator simply loads hobbed pinions into the magazine, as shown, after which they pass through a sizing device and down the chute to the shaving position, where they are picked up between centers. The rotary, helical shaving tool has serrated tooth surfaces for cutting edges. The sizing device consists of two master pinions between which the hobbed pinions pass. Over-size parts are thus prevented from being fed into the machine. As soon as a shaved pinion is automat-

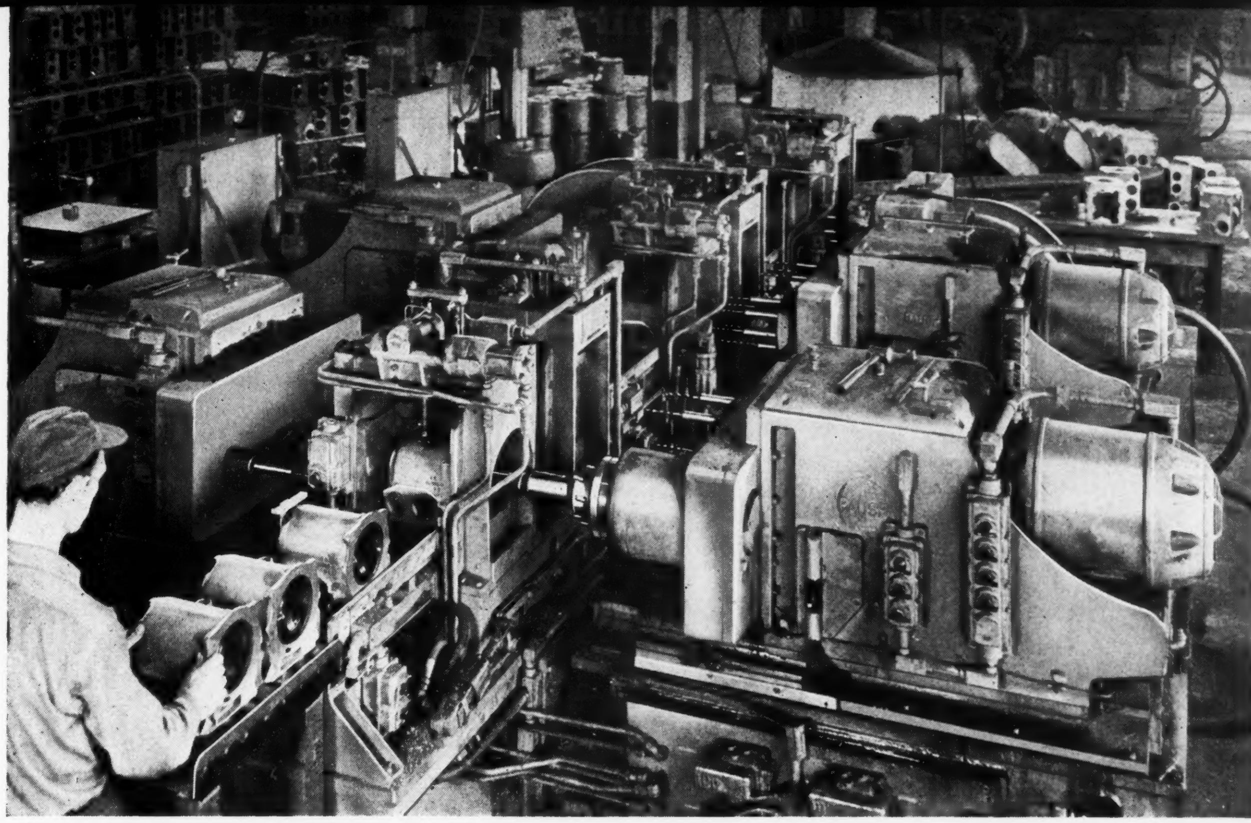


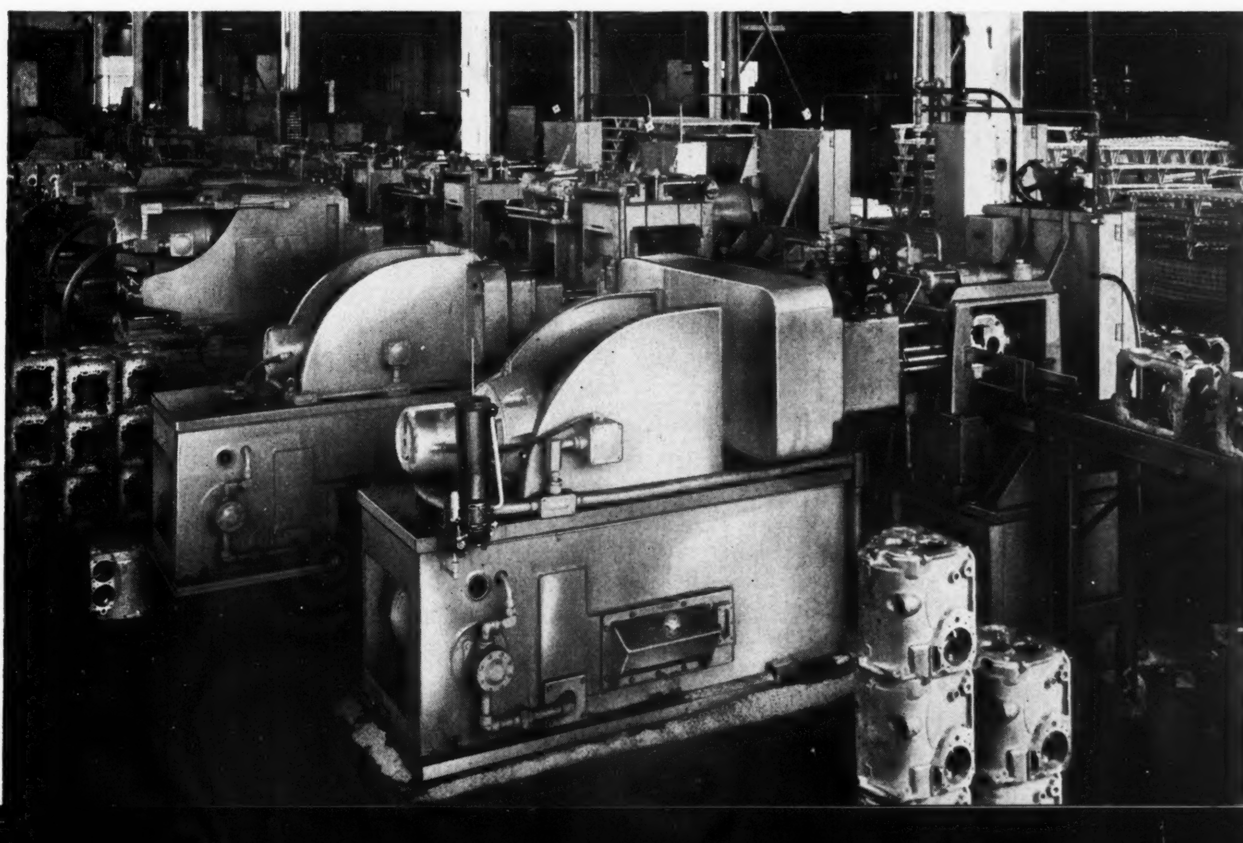
Fig. 3. Loading end of a machining line consisting of two automatic transfer machines, separated by a six-station "pancake" type rotary-indexing machine

ically ejected from between centers, another hobbed pinion falls from the magazine into the shaving position.

The shaved pinions are next carbo-nitrided to obtain a Rockwell hardness of about 90 on the 15N scale and a case depth of from 0.015 to 0.020 inch. The bores of the hardened pinions are subsequently honed, removing about 0.0005 to 0.0010 inch of stock from the bore diameter to obtain a maximum surface roughness of 10 micro-inches r.m.s.

Main cases or housings for the automatic transmission are gray iron castings (SAE 111), approximately 9 inches in diameter and 10 inches long. They are completely machined at the rate of sixty-five per hour on fifteen machine tools, including several automatic transfer machines, that are operated by only ten men.

Fig. 4. Unloading end of the machines seen in Fig. 3. A total of 160 spindles is employed to machine sixty-five transmission cases per hour



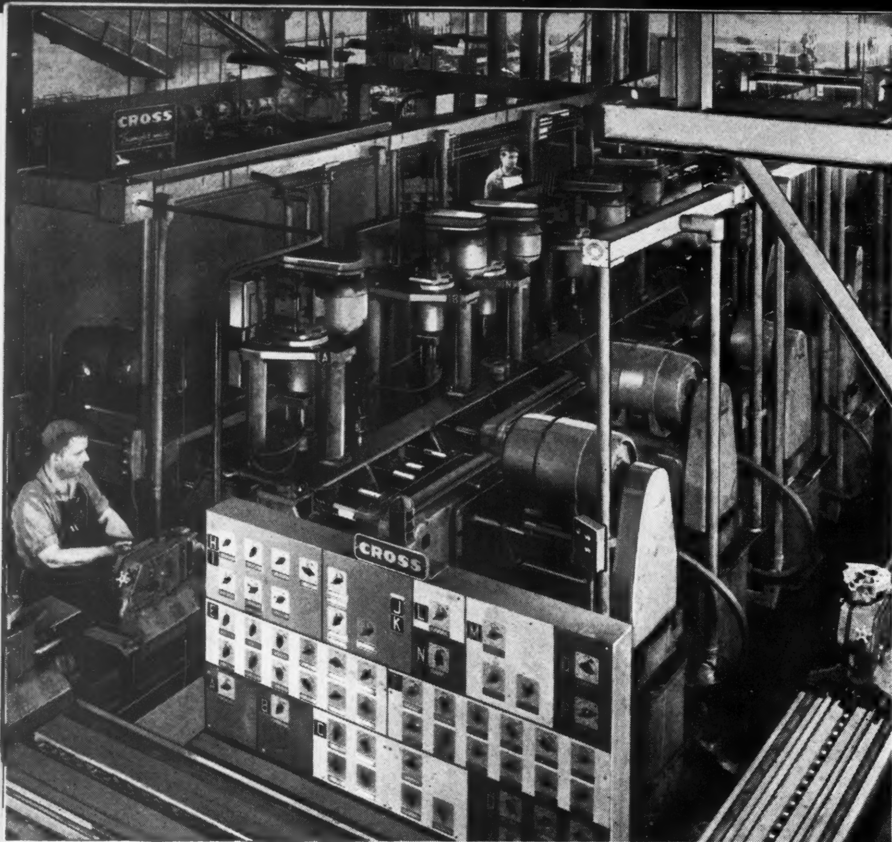


Fig. 5. Automatic transfer machine equipped with ten working stations and seventy-one spindles for drilling, reaming, and tapping transmission case castings

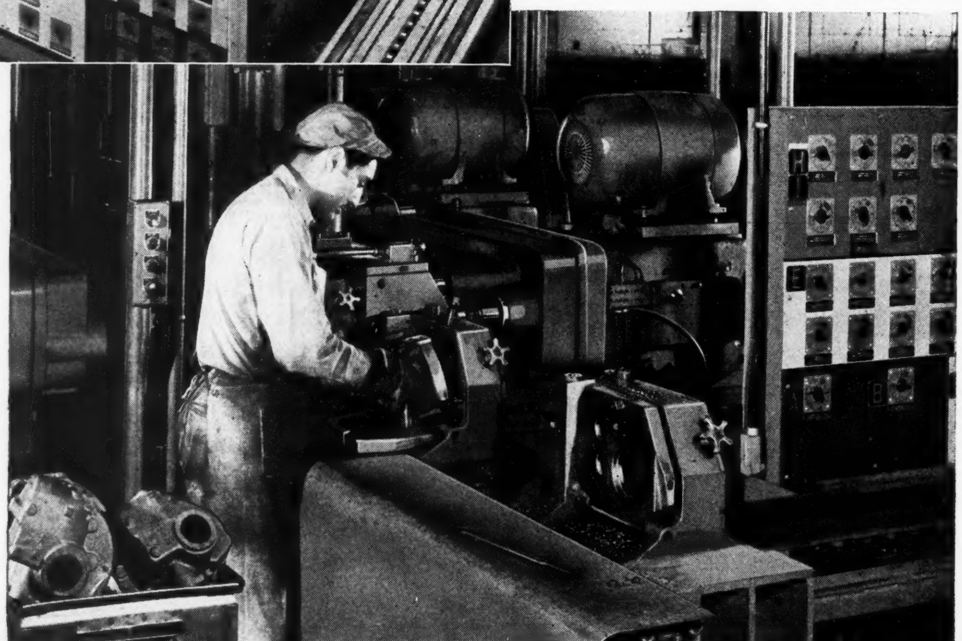


Fig. 6. Loading station of the automatic transfer machine seen in Fig. 5. The castings are loaded on two-position, progressive type pallet fixtures

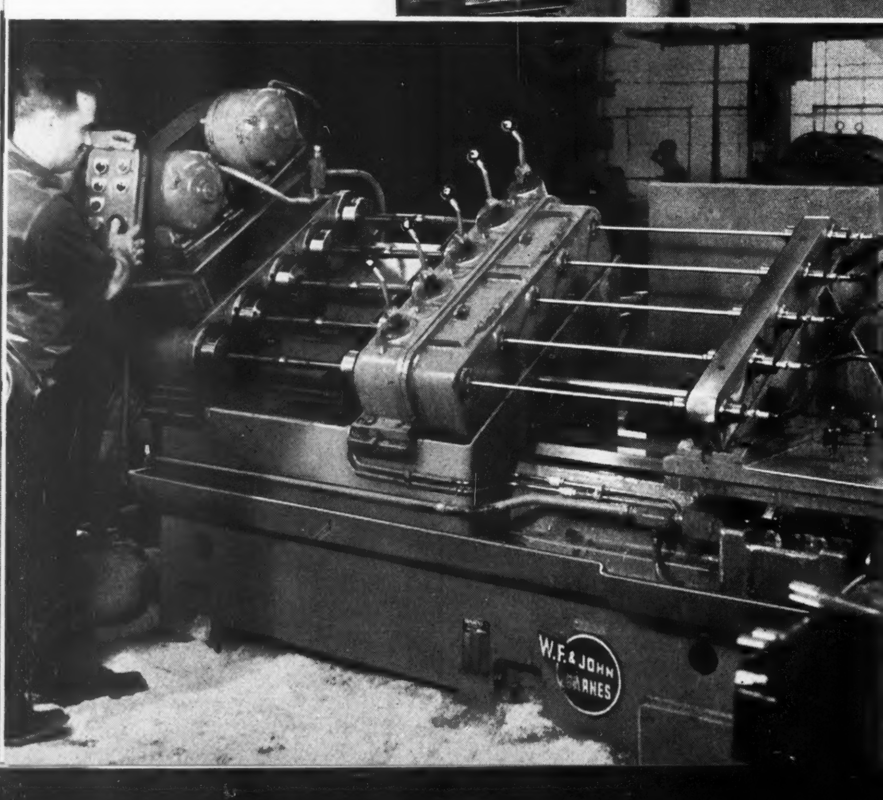


Fig. 7. Five-spindle, deep-hole drilling machine employed to drill holes 0.4823 inch in diameter by 14 inches long in one end of the main shafts

The bottom faces of the transmission-case castings are milled flat on the Davis & Thompson eight-station rotary milling machine seen in the heading illustration. Milled castings move down a gravity roller conveyor to a Baush two-way horizontal drilling machine. The cases are clamped manually in fixtures on the trunnion of this machine, and are indexed successively to the five working stations. Tools held in spindles on both the right- and left-hand heads at these stations drill, ream, countersink, and spot-face thirty-eight holes in the top and bottom faces.

Front and rear faces of the transmission housing are straddle-milled on another Davis & Thompson eight-station rotary milling machine, the over-all length of the casting being held within $\pm$ 0.0025 inch. The sides of the housing are also straddle-milled on a similar machine. In this operation, the over-all width is maintained to $\pm$ 0.005 inch. The partially machined castings then move along a roller conveyor to the line of machines illustrated in Figs. 3 and 4. This line consists of two Baush automatic transfer type machines, separated by a so-called "pancake" indexing type, six-station machine.

In the transfer machines, the transmission housings are automatically carried from station to station by the transfer mechanism, and are clamped in position by cam-actuated plungers. At each station, both left- and right-hand, multiple-spindle heads are hydraulically fed toward the work. In the first machine, the holes in both front and rear faces of the castings are drilled, countersunk, bored, chamfered, spot-faced, or tapped by tools mounted on fifty-seven spindles at the six machining stations.

Eight angular holes are drilled in the bottom face of each housing on the Baush six-station, rotary-indexing, pancake machine. The castings then enter the second Baush automatic transfer machine, the unloading end of which is seen in Fig. 4. In this machine, ninety-five spindles are provided at the ten stations to drill, bore, ream, countersink, and tap the remaining holes in the housings. Before the castings enter the ninth and tenth stations, they are automatically rotated through an angle of 90 degrees to permit tapping the holes in the bottom face. A production of sixty-five housings per hour is obtained from this line of three machines.

Transmission case extensions, which are subsequently assembled to the main housings, are also cast from SAE 111 gray iron. All the holes in these parts are drilled, reamed, counterbored, countersunk, or tapped on the Cross Transfermatic machine illustrated in Figs. 5 and 6. This completely automatic transfer type machine has twelve stations, including one for loading, ten for machining, and one for unloading. Seventy-one drilling (or reaming) and tapping spindles are located on the left-hand, right-hand, and vertical heads at the various stations.

Extension castings are loaded, Fig. 6, on two-position, progressive type, palletized work-holding fixtures. The pallets are automatically transferred from station to station by a hydraulically actuated transfer bar. Also, the fixtures are located and clamped at each station hydraulically. At the completion of the operations, the pallets are rapidly returned to the loading station by means of a chain conveyor seen extending along the right-hand side of the machine in Fig. 5. The castings are fed through the machine twice, their position on the pallets being reversed for the second pass. The production rate on this machine is sixty-five case extensions per hour.

The fifteen standard heads employed on the automatic transfer machine are lettered A to P, inclusive (with the exception of letter G which is reserved for possible future use on an idle station). Corresponding letters, which are

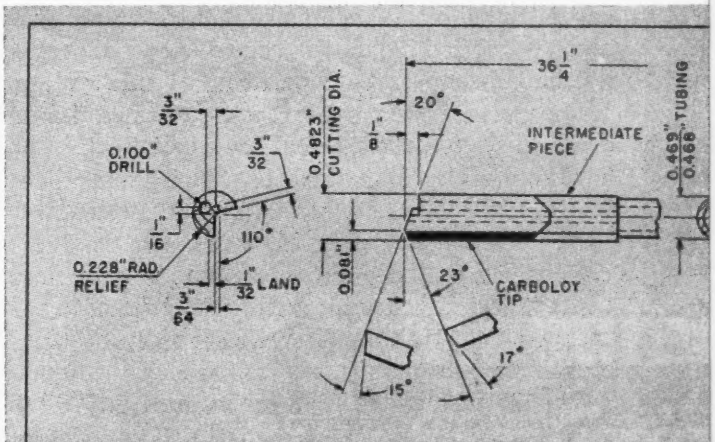


Fig. 8. Details of the carbide tip ground on drills used in the machine shown in Fig. 7. These carbide-tipped drills are made from tubing

color-coded to facilitate locating the heads, are mounted on the control board seen at the front of the machine. The tools on the lettered heads are each represented on the control board by a so-called "Toolometer," or tool-wear counter, which provides a visual record of the used and unused life of the tool.

When any one of the "Toolometer" pointers reaches zero, the machine stops, permitting the tool requiring sharpening to be replaced. The number of hours of productive tool life remaining can be determined at any time by merely glancing at the board. A bench having storage bins, also identified by letters, holds a

Fig. 9. Two stations on a 50-kilowatt, 450,000-cycle, induction heating unit are employed for the selective hardening of four areas on the main shaft of the automatic transmission

set of sharpened tools that are assembled in adjustable holders. The tools are preset to standard lengths by means of gages stored in the bench. Substantial savings in tool-changing time and a reduction in "down" time due to tool breakage have been effected as a result of this system.

Main shafts for the automatic transmission are cold-forged from SAE 8645 bar stock. The hardness of the bar stock is raised from about 20 Rockwell C to between 28 and 32 Rockwell C by the cold-forging process, which also produces the desired multiple-diameter form within close tolerances. Cold forging eliminates the need for through heat-treatment of the shafts and minimizes machining.

The main shafts, 21 3/8 inches long and 1 3/8 inches in diameter (maximum) are drilled, five at a time, on the W. F. & John Barnes machine seen in Fig. 7. The holes, which form blind bores in the shafts, are 0.4823 inch in diameter by 14 inches deep. Centers are drilled in the main shafts prior to this operation, and one of the bearing seats at the end of each shaft is ground to provide a locating and driving surface. Grinding of this surface reduces any "out of balance" due to centrifugal forces, thus improving the accuracy and straightness of the hole drilled. The size of the centers is held to a minimum (never exceeding the diameter of the hole to be drilled), since too large a center would permit the drill to cut on its outer edge only, resulting in an over-size hole.

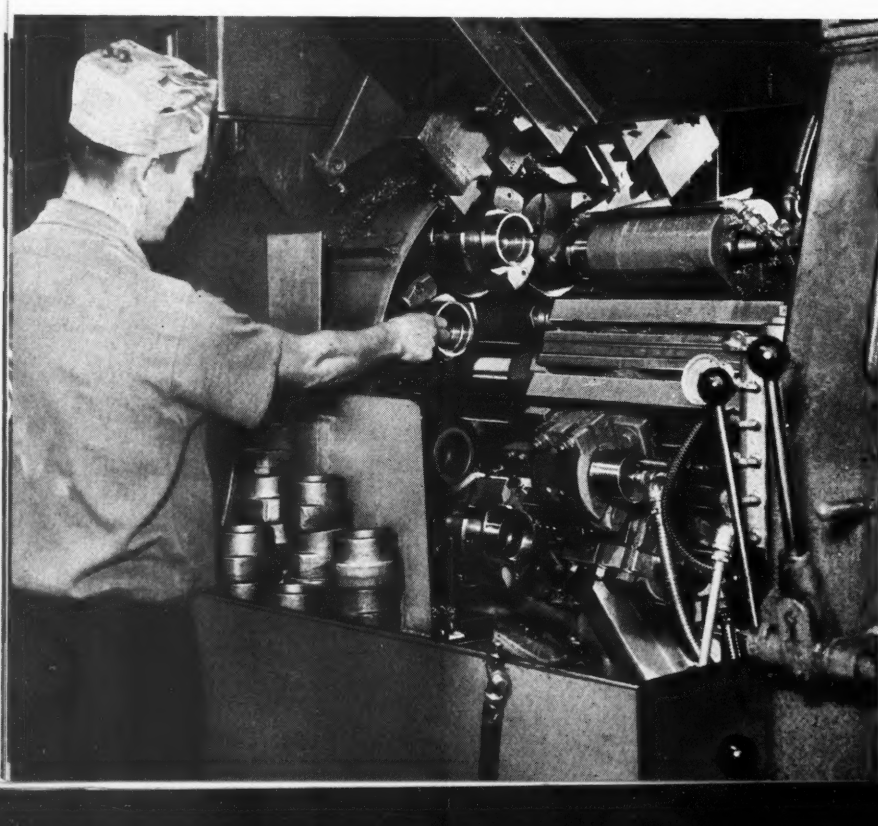


Fig. 10. Eight-spindle single-indexing, hydraulic chucking machine which bores, forms, faces, turns, and chamfers forged-steel planet carriers at the rate of eighty-four per hour

The shafts are supported on live centers in the headstock of the five-spindle machine, and in steel collet type bushings in the tailstock. With the shafts revolving at 1750 R.P.M., the non-rotating drills are fed into the work through bronze bushings at the rate of 0.0012 inch per revolution to obtain a production of twenty-five shafts per hour. One man operates two machines.

A sulphur-base soluble oil, mixed with water in the ratio of 25 to 1, is fed through the hollow gun drills which are 36 1/4 inches long. The tungsten-carbide tipped drills are made from tubing 0.4685 inch in diameter. The angles to which the tips are ground and other tip dimensions are shown in Fig. 8. Approximately 100 shafts are drilled between sharpenings.

The drilled holes are inspected by means of air gages, the size over the entire depth being held within $\pm$ 0.001 inch. The accuracy and finish obtained in this operation have eliminated subsequent reaming. However, the holes are honed because an aluminum valve body must be shrunk-fit into the bores at assembly.

Four areas on the periphery of the main shaft are hardened by means of the induction heating set-up illustrated in Fig. 9. The localized hardened areas are 3/8, 27/32, 2 1/2, and 2 9/16 inches in length, and vary in diameter from 1 to 1 3/8 inches. A surface hardness of 58 to 62 Rockwell C is obtained, and the hardness at a distance of 0.035 to 0.050 inch below the surface is about 50 Rockwell C. Total depth of hardness is kept as shallow as possible—usually 0.070 to 0.100 inch.

The Thermonic induction heater used for this operation is of the vacuum-tube converter type, generating 50 kilowatts of power at 450,000 cycles. The shafts are held vertically at both stations on the unit, three of the surfaces being hardened at one station and one at the other. Two stations, each having a different size coil, are necessary because of the variation in length and spacing of the surfaces to be hardened.

At the station seen at the left, three of the surfaces are hardened by the so-called scanning process. This process is a progressive method of induction heating, where the relatively high power concentrations necessary for surface hardening large areas can be obtained with a low power source by heating a narrow band of the work at a time. The shaft is rotated and moved upward through the two-turn inductor coil.

A hydraulic metering device controls the rate

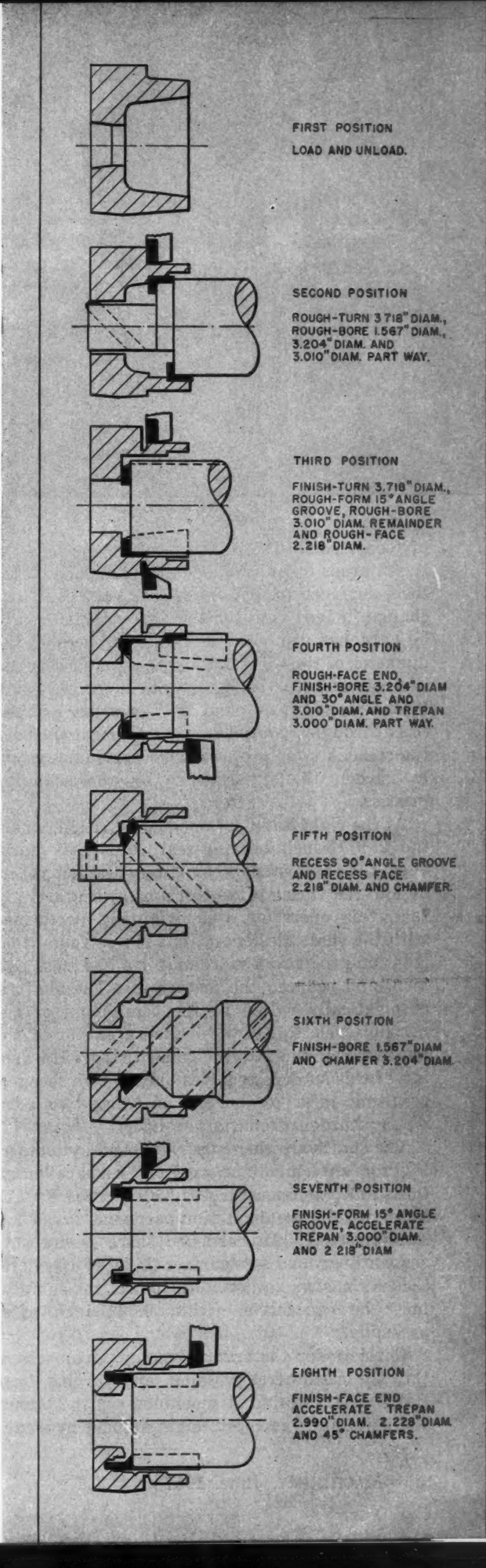


Fig. 11. Details of the carbide-tipped tooling used on the eight-spindle machine seen in Fig. 10. A cutting speed of 360 feet per minute is employed

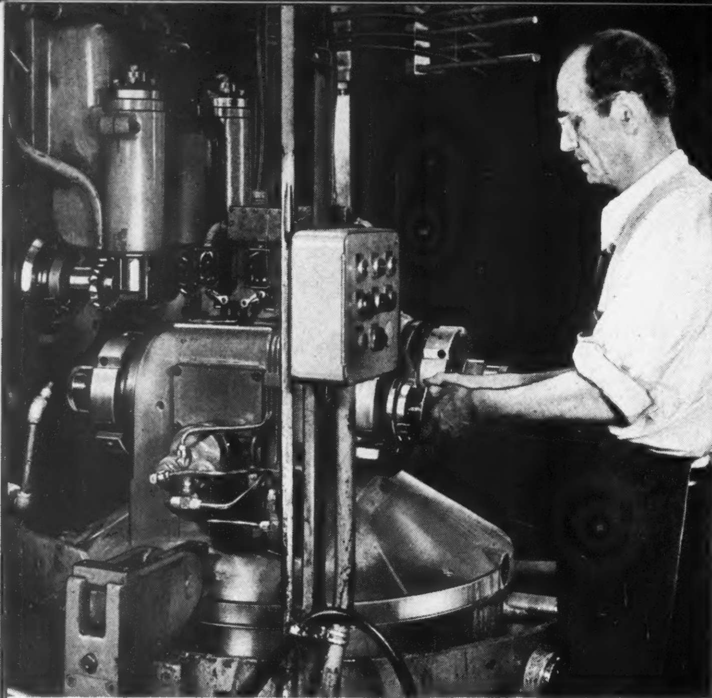


Fig. 12. Special milling machine for cutting three clearance slots in rear planet carriers. Two parts can be loaded on the rotary table while two others are being milled

of feed through the coil, increasing the feed between areas to be hardened and slowing it when these surfaces are passing through the coil. The change in feed rate for the various surfaces to be hardened compensates for differences in the diameter of the shaft and in the spacing between the coil and the periphery of the work. The heated areas are automatically quenched as they pass through a water spray ring located above the coil. A twenty-nine-second cycle is required to harden the three areas by the scanning process.

At the right-hand or "one-shot" station, where the 2 9/16-inch bearing-seat surface is hardened, the shaft is merely rotated, and not raised or lowered through the coil during heating. In fact, this operation was originally performed with the shaft stationary, but it was found that rotation produced a more uniform hardness pattern, and reduced the distortion. The shaft is automatically raised at the completion of the heating cycle to lift the heated area out of the ten-turn coil and into the quench ring. Hardening of this surface requires only twelve seconds, resulting in a production of thirty-two completely hardened shafts per hour.

The shafts are then stress-relieved by tempering for an hour in a gas-fired furnace maintained at a temperature of 350 degrees F. All holes within the induction-hardened areas are sand-blasted. The hardened surfaces are subsequently ground to a surface finish of 10 micro-inches r.m.s. maximum. All four of the surfaces must be concentric within 0.002 inch after assembly.

Carriers for the front planetary gear sets of the automatic transmission are forged from S A E 1141 steel and machined on the Acme-Gridley 8-inch capacity, eight-spindle hydraulic chucking machine seen in Fig. 10. In boring, forming, facing, turning, and chamfering the forgings, a total of 2 1/2 pounds of metal is removed. The completely automatic machining cycle requires only thirty-four seconds, and a production of eighty-four carriers per hour is obtained.

The machine is equipped with a power-feed reversing mechanism which eliminates hand-cranking and saves time in setting up work or changing over from one job to another. Also, the hydraulic chucking mechanism insures that the work is held in line against the thrusts of high-speed operation with multiple carbide tools.

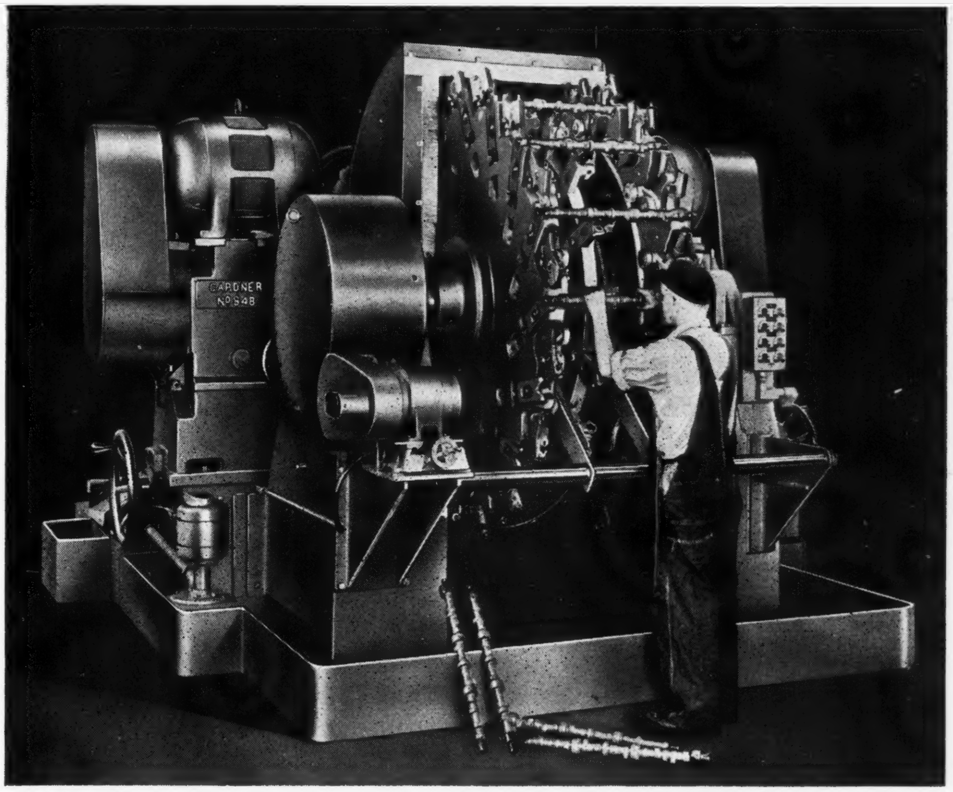
Details of the tooling employed on this eight-spindle, single-indexing, chucking machine are shown in Fig. 11. The work is loaded at the first position, a finish-machined planet carrier being removed and replaced by a forging at the end of each cycle. The forgings are gripped on their maximum diameters by means of hydraulically actuated three-jaw chucks, and located against the faces of their large-diameter ends. When the part has been indexed to the second position, it is rough-turned and rough-bored part way on three different diameters. All four of the tools are mounted on the main end tool-slide, three being held in a boring-bar and the fourth on a knee-turner.

At the third position, the part is finish-turned by means of a knee-turning tool mounted on the end slide, and rough-grooved with a flat 15-degree angular form tool held on the cross-slide. Also, the 3.010-inch diameter is rough-bored for the remainder of its depth, and the internal shoulder adjoining this bore is rough-faced by means of four tools held in a boring-bar on the end slide. A tool mounted on the cross-slide at the fourth station rough-faces the small-diameter end of the planet carrier, while three tools held in a boring-bar on the end slide finish-bore the 3.010- and 3.204-inch holes and trepan part way a recess 3.000 inches in diameter.

Next, an internal groove forming an included angle of 90 degrees is recessed, the internal shoulder is recessed to a diameter of 2.218 inches, and the back face of the forging is chamfered by tools mounted on a swing type recessing fixture at the fifth position. A hydraulic locking mechanism is employed at this station to hold the swinging fixture in position during machin-

(Concluded on page 174)

Unusual Applications of Disc Grinding Machines



While Double-Spindle Disc Grinding Machines are Widely Used for Grinding Two Opposed Parallel Surfaces on a Part Simultaneously, They can Also be Applied to Many Other Types of Metal-Finishing Operations

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DISC grinding machines are being increasingly applied in modern manufacturing methods for the production of flat surfaces. Since about 1895, when the first grinder of this type was designed to remove metal by passing work over the face of an abrasive disc, thousands of different parts have been successfully ground by this method—many to very close tolerances, with a fine surface finish.

Today, the disc grinder is an important machine in the metal-working field, and its use has been extended to grinding plastic, ceramic, composition, rubber, and building materials as well. While double-spindle disc grinding machines are most widely used for the grinding of two opposed parallel surfaces on a part simultaneously, there are many other operations for which such machines are well suited. Unusual applications of disc grinding machines made by the Gardner Machine Co. will be described in this article.

The joining edges of plowshares and moldboards for agricultural plows are ground on the specially equipped, vertical-spindle disc grinder seen in Fig. 1. This machine has a four-station, rotary work-holding fixture that will handle any size plowshare or moldboard, both right- and left-hand, up to and including 24 inches in length. A self-locking, air-operated work-clamping mech-

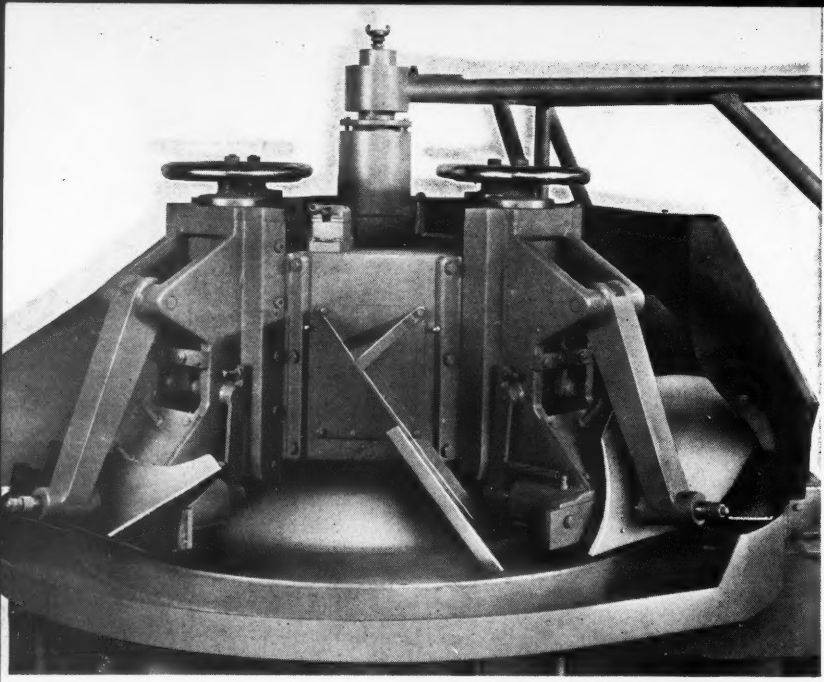


Fig. 1. Vertical-spindle disc grinder equipped with a four-station, rotary work-holding fixture for grinding the edges of plowshares

anism prevents the parts being ground from becoming unclamped in case of air pressure failure.

This mechanism can be adjusted to accommodate either moldboards or plowshares in any of the four stations by the use of adapter plates. Moldboards are located on the adapter plate by means of pins which enter holes along the edge to be ground, while plowshares are positioned by means of two special locators that are automatically retracted when clamping pressure is applied.

A 24-grit, aluminum-oxide abrasive wheel, 53 inches in diameter by 1 inch thick, is employed on this machine. From 1/16 to 3/32 inch of stock is removed from the joining edges of the workpieces, maintaining flatness within 0.002 to 0.003 inch. Production varies from 120 to 150 parts per hour, depending upon the size of the work.

Another unusual application of a disc grinder is illustrated in Fig. 2. Here the periphery or crown of cast-iron belt pulleys is being ground. This machine can accommodate pulleys from 10 to 17 inches in diameter and 6 to 8 inches wide. The single horizontal grinding spindle is equipped with a ring type abrasive disc, 26 inches in diameter by 2 inches face width. A combination pneumatic-hydraulic controlled table is provided for moving the work toward or away from the abrasive disc, either rapidly or slowly.

The top of the fixture base has a horizontal dovetailed way on which is mounted a longitudinal slide with a handwheel and feed-screw mechanism to permit adjustment for abrasive wear, control the amount of stock removed, and adjust for the size pulley to be ground.

Since the radius of the crown produced on the pulley depends upon the relative location of the pulley and the abrasive disc, a cross-slide—also with a handwheel and feed-screw mechanism—is provided above the longitudinal slide to adjust the fixture for different crown radii. A vertical spindle, mounted in anti-friction bearings on the upper cross-slide, is provided with a circular flange to accommodate different fixtures for various sized pulleys. The fixture and work are rotated by means of a variable-speed worm-gear drive, and intermittently fed by a cam-operated valve.

A hand-clamp holds the pulley in place on the vertical spindle during grinding. The grinding cycle is begun by depressing a foot-operated

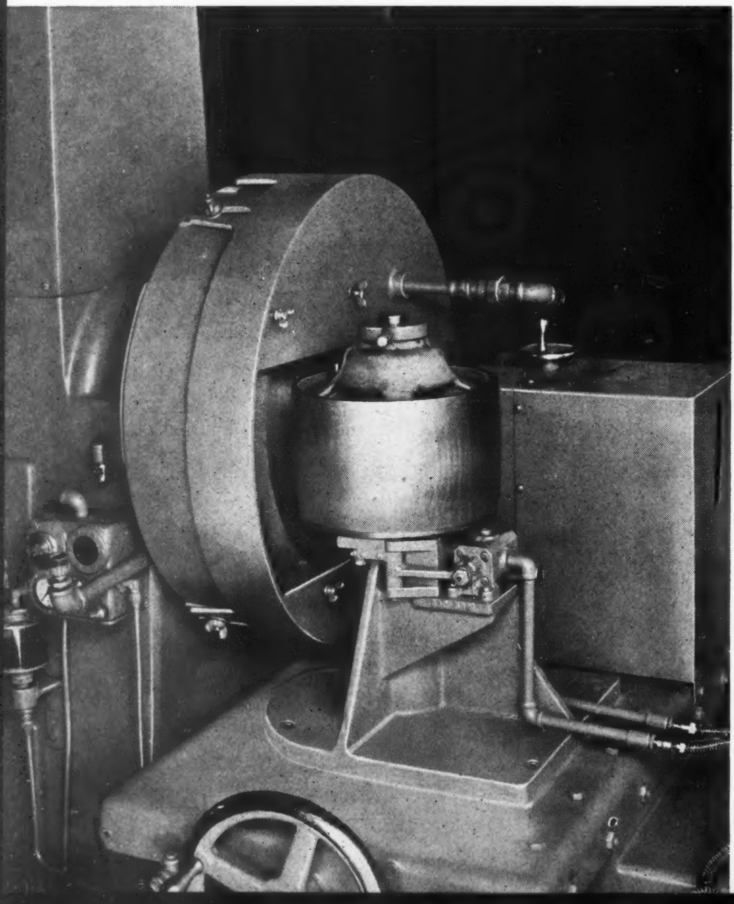


Fig. 2. Crowns of cast-iron belt pulleys from 10 to 17 inches in diameter are ground on this single-spindle disc grinder

control valve, which causes the fixture to move toward the abrasive disc at a rapid rate and to slow down automatically before contacting the disc. The operator feeds the work-piece forward by hand until the disc contacts the work, and then engages the automatic feed.

The cam-operated valve feeds the fixture toward the disc a pre-set amount for each revolution of the pulley being ground. When the pulley has revolved the number of times required to grind the surface completely, the fixture is returned by rapid traverse to the starting position for unloading.

Standard single-spindle disc grinders can often be equipped with a hydraulically operated surface grinding table, Fig. 3, on which special fixtures can be mounted for grinding various shaped work-pieces. A bracket on one end of the machine is provided with a compound slide which permits the table to be moved toward the abrasive disc to compensate for disc wear and control the amount of stock that is removed from the work-piece.

On the machine shown, four hand-operated, quick-acting clamping fixtures are used successively to grind various surfaces on steel hay knives. The fixtures can be quickly changed, and are securely fastened to the surface grinding table by T-bolts. Location of the knife in the fixtures is accomplished by means of buttons spaced to fit corresponding holes in the work-piece. Straight, beveled, and angular surfaces on the knife are successively ground, removing about 1/32 inch from the straight surfaces and sufficient stock to achieve the desired angle on the angular surfaces. From ten to fifteen seconds is required for grinding the straight surface, and from two to three minutes for the angular faces.

Disc grinders are used extensively in the manufacture of coil springs for grinding the ends square. Springs varying from 1/4 inch to 12

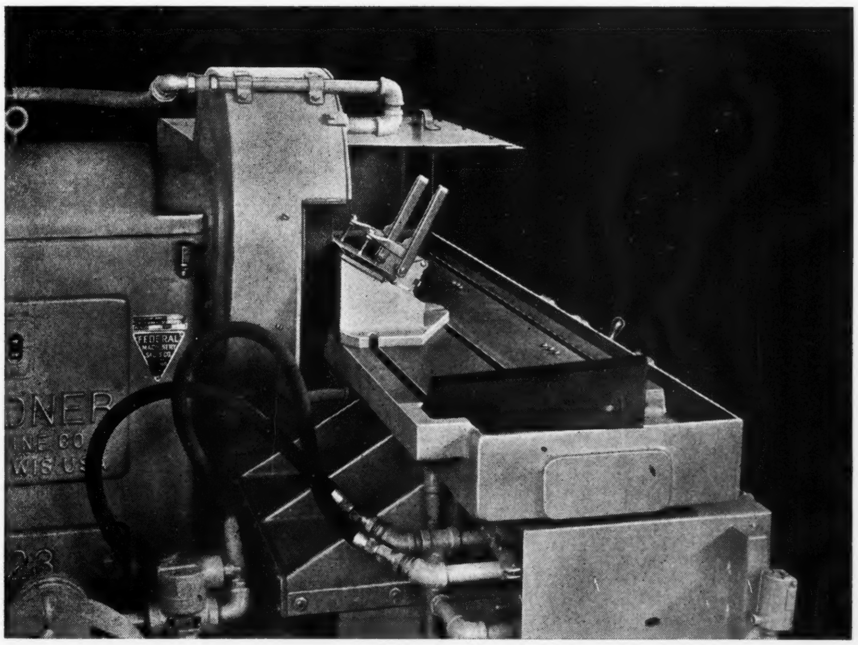


Fig. 3. Both straight and angular edges of hay knives are ground by mounting various fixtures on table of this single-spindle disc grinder

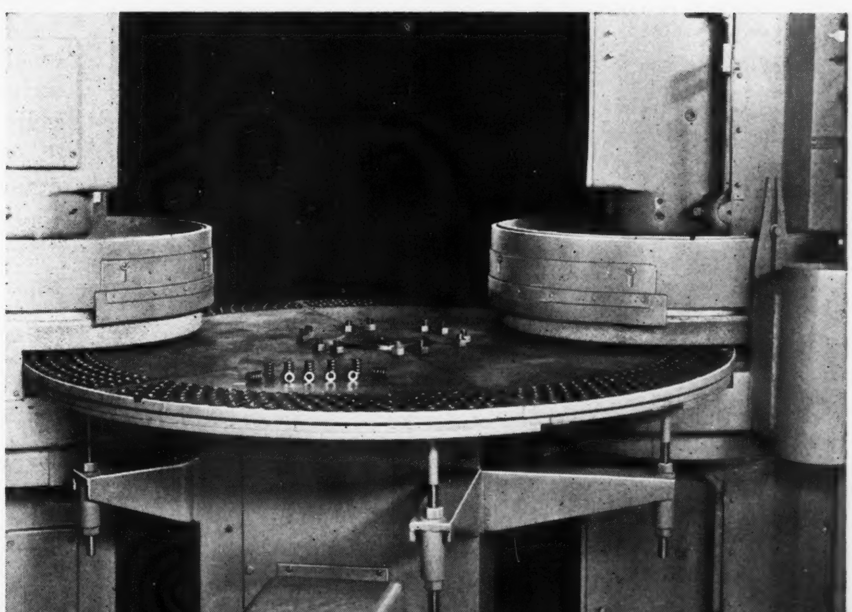


Fig. 4. Two pairs of abrasive discs, each 30 inches in diameter, are employed to rough- and finish-grind the ends of coil springs at the rate of 3200 per hour

inches in diameter (with wire ranging up to 2 inches in diameter) are ground in this way on different sizes and types of disc grinders. One such grinder, which is being successfully employed for high-production flat grinding of both ends of coil springs 1 inch long by 3/4 inch in diameter, made from 0.135-inch diameter wire, is seen in Fig. 4. This machine has two sets of abrasive discs, each set being carried on an upper and lower vertical spindle.

The coil springs are loaded manually in the large, horizontal rotary carrier. As the springs pass between the first pair of 30-inch diameter abrasive discs, about 0.100 inch of stock is removed from both ends. They are then carried between the second set of discs for finish-grinding, 0.065 inch of stock being removed in this operation. The completed springs drop from the holes in the carrier plate as they leave the finishing discs. Squareness of the spring ends is maintained between 1 and 1 1/2 degrees, and a production of 3200 springs per hour is obtained. Other size springs can be ground on the same machine by simply substituting another rotary carrier of the proper capacity and adjusting the grinding heads vertically.

Snag grinding of both ends of different lengths of camshafts is economically handled by means of the double-spindle disc grinding machine shown in the heading illustration. The two abrasive discs of this huge machine are 40 inches in diameter by 3 inches thick, and each is driven by a 40-H.P. motor. Both grinding heads are adjustable lengthwise on the base of the machine, so that camshafts varying from 18 to 36 inches in length can be handled.

A double type rotary carrier, Fig. 5, which is also adjustable to suit camshafts of different lengths transports the work-pieces between the abrasive discs. The two large circular carriers are equipped with V-blocks which support the ends of the camshafts. The operator places a camshaft into a pair of V-blocks, where it is held in place by a cam-actuated clamp. A centering guide locates the camshaft endwise from the shoulder of the center main bearing before it is carried between the abrasive discs. At this point, a second cam automatically applies clamping pressure to hold the camshaft firmly during the grinding.

When the parts leave the discs, the clamp is released automatically, allowing the ground shaft to fall onto a conveyor. Maximum stock removal from each end of the camshaft is 3/8 inch, and a production of about 1000 camshafts per hour is obtained.

Chain conveyors have proved to be a very satisfactory method of carrying work-pieces through a double-spindle disc grinder in a straight line. Such a high-production set-up is illustrated in Fig. 6. In this operation, flash or bulges caused by forming are ground from the parallel sides of brake-shoe assemblies.

The assemblies are loaded on the chain conveyor manually, being located by side guides as they are automatically carried between the 20-inch diameter abrasive discs. An upper guide also holds the parts in place while they are being ground. As the completed parts pass from between the discs, they fall from the conveyor. A production of approximately twenty-five pieces per minute is obtained.

Feed-through fixtures, in which the work-pieces are fed continuously between the abrasive discs by means of one or two pairs of power-driven adjustable-speed rubber rolls or V-belts, are often used for high production of medium-sized parts on double-spindle disc grinders. Adjustable guide bars are provided above and below the work-pieces so that they pass between the disks at

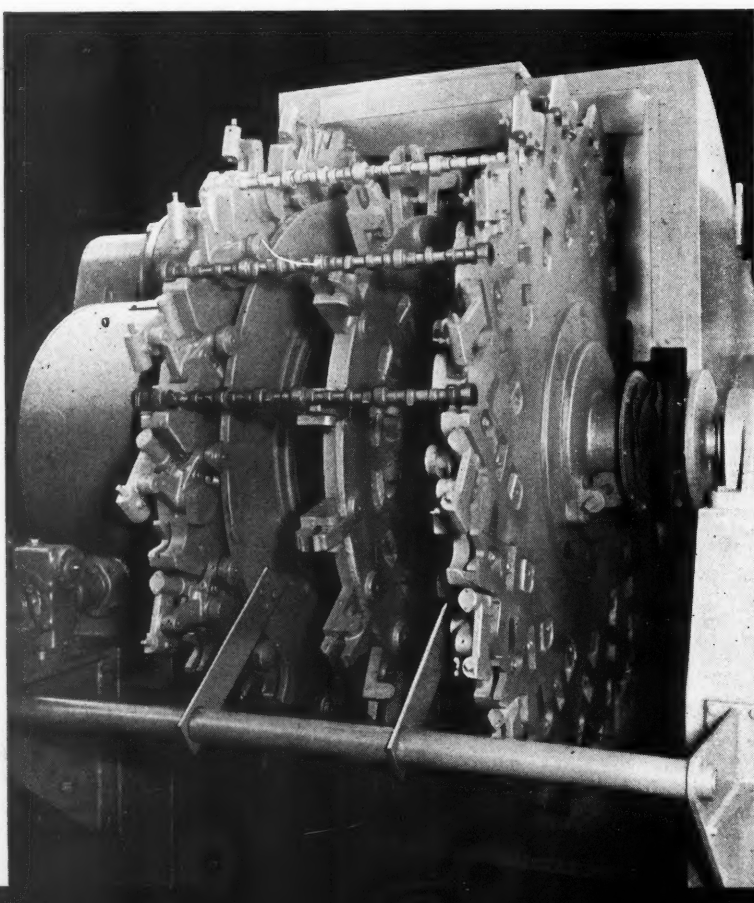


Fig. 5. Both ends of camshafts varying from 18 to 36 inches in length are snag-ground on this large double-spindle machine at the rate of 1000 per hour

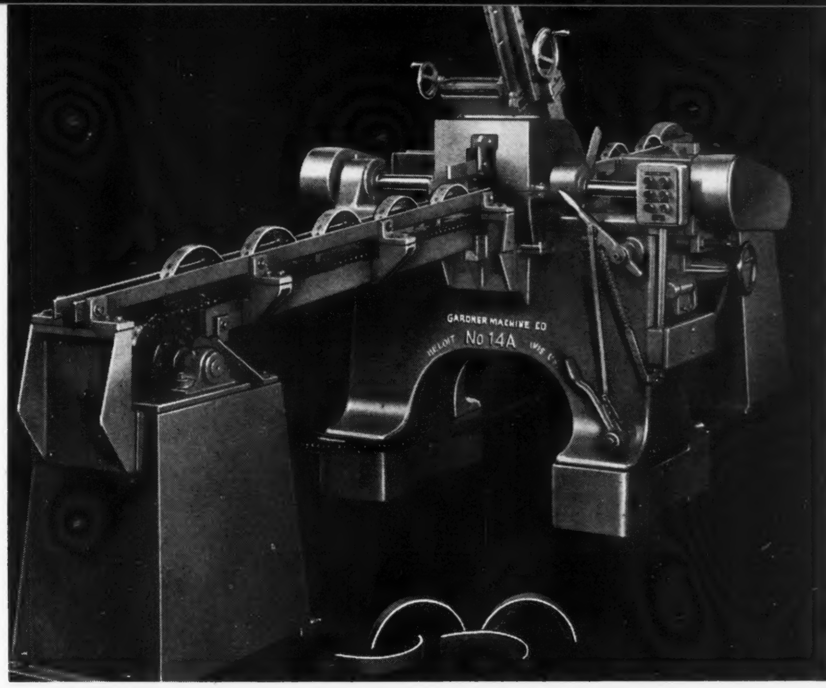


Fig. 6. Parallel sides of brake-shoe assemblies are ground at the rate of twenty-five per minute by means of a chain-conveyor work-feeding fixture

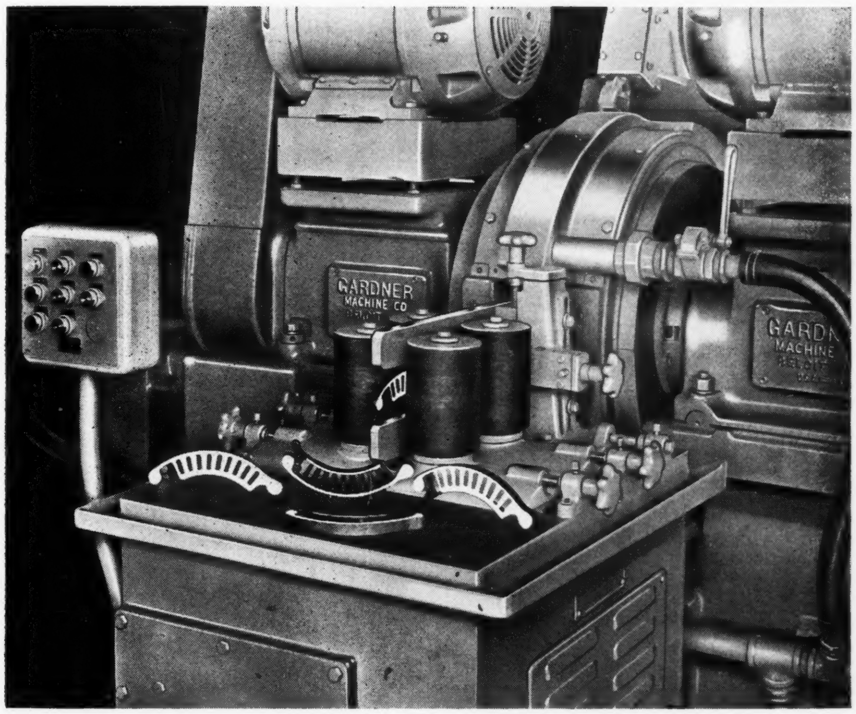


Fig. 7. Feed-through fixture employs two pairs of adjustable-speed rubber rolls for feeding the work-pieces continuously between the abrasive discs

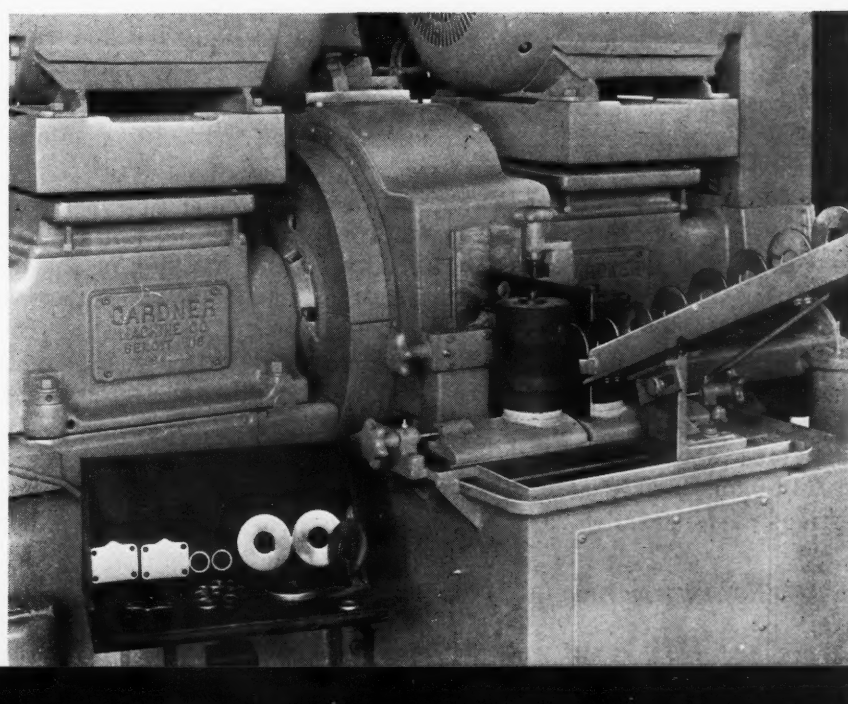


Fig. 8. Parallel sides of flat washers and plates are ground at the rate of twenty to twenty-five per minute on this double-spindle disc grinding machine

Fig. 9. A roller gun type fixture is employed to oscillate meat cleavers between the opposed abrasive discs of this grinder

their center lines and fall from the rear of the machine.

Such a feed-through fixture is shown in Fig. 7, mounted on a double-spindle disc grinding machine employed to grind the parallel sides of business machine key frames. As can be seen, unequal areas must be ground on the faces of the odd-shaped cast-iron keys. For this reason, two passes are made, removing a total of 0.075 inch of stock from the parts. Parallelism of the sides is maintained within 0.001 inch, and each pass is completed at the rate of twelve pieces per minute. A magnetic separator is provided on this machine to keep the coolant clean and aid in maintaining a fine surface finish on the ground parts.

An inclined trough has been added to the roll-driven, feed-through fixture seen mounted on a double-spindle disc grinder in Fig. 8. In this set-up, parallel sides of various sized flat washers and plates are ground between two 26-inch diameter abrasive discs. Work-pieces placed in the trough roll or slide down to a pair of variable-speed, power-driven rubber rolls, which, in turn, feed the parts between the discs. Approximately 0.020 inch of stock is removed from the various parts, parallelism of the sides being held within 0.002 inch. The production rate varies between twenty and twenty-five pieces per minute, depending on the size of the part.

Another simple but efficient work-holder which can be adapted to double-spindle disc grinders is the roller gun type fixture illustrated in Fig. 9. Such a hand-operated device is generally employed for odd-shaped pieces that require the removal of a large amount of stock, and for applications where production requirements are not too high. In the set-up shown, the gun type fixture is used to feed meat cleavers between opposed, 20-inch diameter abrasive discs.

The cleavers, made from hot-rolled, high-carbon chromium-vanadium steel, are 5 inches long by 1 7/8 inches wide by 1/8 inch thick, and the surface area to be ground is approximately 11 square inches. The cleaver is inserted in the cut-out of the feed-blade and oscillated by hand between the abrasive disks. Three or four cleavers can be ground per minute, removing from 0.010 to 0.015 inch of stock. Parallelism is maintained within 0.003 inch.

* * *

Tool and Die Industry Reports Increased Business

Tool and die orders for the first quarter of this year were 165 per cent ahead of the first quarter last year, according to an estimate recently released by the National Tool and Die Manufacturers Association. It was also disclosed that shipments were 150 per cent ahead the first quarter of this year, compared with the corresponding period last year, but 7 per cent below shipments made in the last quarter of 1950. The backlog of the industry at the end of February was 225 per cent that of a year ago.

Employment during the same period has not increased as rapidly. It is up less than 25 per cent, due to the fact that the skilled labor needed for precision tool and die making is not available. This situation may become worse, according to members of the Association, if labor pirating is not retarded.

Machine Tool Builders Consider Difficulties in Building for Defense

BUSINESS sessions of the forty-ninth spring meeting of the National Machine Tool Builders' Association, held May 3 and 4 at the Edgewater Beach Hotel in Chicago, Ill., were principally devoted to a discussion of the manifold problems placed on the machine tool industry by the lack of understanding on the part of Government agencies of the vital role which this industry must necessarily play in the successful culmination of the national defense program. Because of severe handicaps, which were pointed out by Richard E. LeBlond, president of the Association and president of the R. K. LeBlond Machine Tool Co., the industry will produce in 1951 less than one-third of the production in 1941, when the nation was in a similar state of emergency.

Mr. LeBlond called attention to the fact that in the last war machine tools were given precedence and priorities, not only in the United States, but also in Germany and England. There was a general recognition that nations could not get planes, tanks, and guns until after they had machine tools. Right after Pearl Harbor, the machine tool industry was given pool orders, accompanied by 30 per cent cash, and the Government provided every possible assistance to enable the industry to rapidly increase its output.

The Government today, Mr. LeBlond mentioned, is not extending such cooperation, with the result that the national defense program will not materialize in the volume or in the time the public expects. Makers of planes, tanks, guns, and other defense materiel will be unable to meet their schedules due to lack of machine tools unless the present situation is changed.

Vital expansion of the machine tool industry has been checked by the combination of manpower shortage, uncertain price regulation, and the absence of a blanket priority for raw materials, according to M. A. Hollengreen, chairman of the Public Relations Committee, and president of the Landis Tool Co. In his paper "Dilatory Defense," Mr. Hollengreen mentioned that the output of the industry fell off tremendously after World War II because of the enormous government surplus of machine tools which flooded the market at low prices, and pointed out that this accounted for the low level of the industry at the time the Korean War started. Many machine tool builders were working thirty or forty hours a week and had laid off employes up to men of thirteen or fourteen years' experience. Employment in June, 1950, for the entire machine tool industry amounted to only 37,700 wage earners.

Mr. Hollengreen listed the following obstacles to present production: (1) Difficulty in holding trained men—and in employing new men; (2) difficulty in getting materials and components without a blanket priority; (3) great delay in securing Certificates of Necessity to permit the five-year amortization of investment in additional facilities; (4) lack of money to finance a larger inventory and increased manufacturing facilities; and (5) uncertainty as to the price ceiling on machine tools.

Despite the desperate need of the industry for raw materials and unit parts, the National Production Authority refused to give the industry a rating, even though it uses only about two-tenths of one per cent of the nation's steel production, a little over one per cent of the anti-friction bearing production, and even smaller portions of other scarce materials. The Controlled Materials Plan will help machine tool builders only in the matter of steel plate, bars, castings, and forgings. On all other materials there is still a jumbled priority situation.

Mr. Hollengreen stated that the nature of a pool contract is widely misunderstood. A pool order is an underwriting of a certain number of machines. The order is placed at the end of the production schedule, which for most machine tool builders is about twenty months away. Pool contracts have the advantage that if the bottom drops out of the defense program and some of these machines are in the process of manufacture and not yet assigned to substitute customers, the machine tool builder will not suffer serious loss, because manufacturing costs will be defrayed by the General Services Administration.

One of the difficulties of the price situation according to Mr. Hollengreen is that the Office of Price Stabilization insists that an effort be made to roll prices back to pre-Korean days, that is, to June, 1950. This would plunge machine tool builders into an obsolete cost-price ratio, which would result in substantial losses. Actual dollar increases in costs can be added to these prices, but this applies only to certain items of cost. For example, the following increases cannot be included: Added insurance; duplication of jigs, fixtures, and patterns in order to increase output; increased clerical help, except as

included in factory labor; campaigns for bond sales, Red Cross, etc.; multiple-shift operations; and training new help. It is believed that overtime premiums, shift premiums, and the much higher costs that result from sub-contracting may eventually be allowed, with some restrictions.

In his report, Tell Berna, general manager of the Association, stressed the fact that every machine tool builder will shortly face the renegotiation of his business under the Renegotiation Act of 1951. Although regulations covering the renegotiation procedure may not be available until this fall, it is known that it will be necessary to segregate the orders subject to renegotiation and it may be far easier to do this as orders are received.

There are two kinds of exemptions in the Act —mandatory and permissible. Among the mandatory exemptions are contracts placed by public utilities, ECA, or a foreign government. Similarly, since contracts for office supplies are exempt, orders from a manufacturer of office equipment may be wholly or partially exempt. There are many categories of exempt contracts, partial and complete, and a full knowledge of these categories is necessary to insure against an overstatement of renegotiable business. Permissible exemptions will not be known until the Renegotiation Board determines them and publishes a list.

Frank W. Pensinger, chairman of the Committee on Advertising, and advertising manager of the Monarch Machine Tool Co., in his paper "The Role of Advertising," outlined a proposed program of Association advertising, which has been planned to inform and influence government officials, members of Congress, American industry, the financial community, editorial opinion, and all thinking people generally. The plan is not intended to supplant any portion of individual advertising efforts, but to make these efforts more effective. Lay-outs of proposed advertisements for this program were shown on a large screen and the costs incident to carrying out the program were discussed.

Mr. Pensinger called attention to the vital part taken by the trade magazines connected with the machine building industries in educating manufacturers concerning the economies that are achieved through replacement of obsolete machine tools in metal-working shops.

A letter from Charles J. Baker of the Economic Cooperation Administration referred to our obligations to supply raw materials and machine tools to those North Atlantic Treaty countries whose plants produce military items for their defense programs. He pointed out that it is an ECA responsibility to see that requests of those countries for materials to be procured from the United States are justified and, if so, delivered in time to meet production schedules.

In addition, ECA has the responsibility of carrying out its original mandate of European recovery. Mr. Baker referred to the fact that this responsibility has fallen on hard times; under the Government's present priority system of DO ratings, factories in Marshall Plan countries which have envisaged modern machinery from the United States will have to wait. Even with DO ratings, these machine tools will be delivered from 30 per cent of a builder's production in any one month in accordance with NPA Order M-41.

In the event that delivery of certain machine tools of critical importance to the production programs of our European allies cannot be made from the 30 per cent, it is possible that a decision will be made by the United States military authorities to permit allocations from the 70 per cent reserved for our military needs.

In his paper "Salesmanship Never Takes a Holiday," Donald M. Pattison, chairman of the Committee on Sales and Service, and vice-president of the Warner & Swasey Co., expressed the opinion that our salesmen today are too sanguine. He said "They have again gotten to the point, as they did during World War II, where they have subconsciously built up in their own minds the idea that today's activity is normal. Unquestionably, they have avoided telling customers the plain unvarnished and disagreeable facts. Competition, in their minds, has not given way to cooperation. This situation is a responsibility of sales management even more than of salesmen. Let's insist that we take an hour to say 'No,' and that we cooperate to help solve each individual problem presented to us."

Mr. Pattison said that every machine tool builder should make certain that his field engineers and sales personnel are exercising all their ingenuity to see to it that defense contractors are getting maximum production from equipment presently installed. They should assist users in every way possible to have machines properly retooled for defense jobs. The manufacturers' representatives should also check machines as to their needs for proper repairs. Mr. Pattison stressed the point that the industry should not overlook the fact that the time will come again when most new orders will be the result of replacements by present and past customers.

Other notable talks were given by Rudolph W. Glasner, president of the Clearing Machine Corporation, and Joel Barlow, counsel to the Association and member of the firm of Covington & Burling, the latter being the speaker at the dinner meeting.

Helical-Wire Thread Inserts Permit Salvage of Fuel Pumps

Fig. 1. Badly worn thread in valve port opening of fuel-pump casting is drilled out and the casting is rethreaded with a special tap

FUEL-PUMP castings formerly scrapped because of worn or stripped threads are now being salvaged by the use of helical-wire thread inserts in the rebuilding department of a Long Island oil-burner dealer. These inserts, made by the Heli-Coil Corporation, provide strong corrosion-resistant threads that are quickly installed.

Between ten and twenty defective fuel-unit castings, or approximately 1 per cent of the units processed, are repaired by the wire-insert method in the machine shops of Sid Harvey, Inc., Valley Stream, N. Y., each week. At a saving of $3 and more per casting, this amounts to a yearly saving of over $2000. Equally important, these thread inserts permit the continued use of castings that might not be replaceable.

Repair operations follow this procedure: (a) The damaged thread is cut out, using a drill larger in diameter than the major diameter of the original thread; (b) the hole is rethreaded with a special over-size tap (Fig. 1); and (c) a helical thread insert is installed. In the installation, the operator gives the "Heli-Coil" insert a starting turn into the new thread by hand, and then positions the inserting tool as seen in Fig. 2. The insert is then screwed into the pump casting until it is a quarter to a half a turn below the machined surface of the boss.

In its free state, the insert has an outside diameter larger than the diameter of the tapped hole. The action of the inserting tool compresses the insert to slightly less than the outside diameter of this hole. Upon removal of the inserting tool, the insert expands and permanently locks itself in place. For a through hole, the notched tang of the insert is bent back and forth a few times with pliers. This detaches it from the insert. Blind holes do not require removal of the tang. The entire operation can be completed in five minutes.

Fig. 2. A helical-wire insert is started into the new thread by hand and then rotated into final position by a special inserting tool

Originally, castings having damaged threads were salvaged by tapping the thread to the next larger size, and making over-size parts to fit. This required from two to three man-hours. Neglecting material costs and considering only the labor charge, it was found that repair costs amounted to more than the casting was worth. For this reason, thread repair operations by the over-size thread method were soon discontinued. From that time until the wire-insert method was instituted, all fuel-pump castings having damaged threads were discarded as scrap. During the last two years, over 1500 fuel units have been repaired with helical-thread inserts. In addition to the cost saving per unit, none of these has ever come back because of damage to the insert or unsatisfactory sealing qualities.

The strength of the 18-8 stainless steel wire from which the inserts are made prevents the stripping of threads when the plugs are tightened excessively. The tough, smooth surface of the wire insert makes thread wear practically negligible and provides good seating qualities between both the casting and the valve plug units. The latter is important to successful operation of the pumps under high pressures and vacuums. All units repaired with "Heli-Coil" inserts are tested under pressures up to 200 pounds per square inch and vacuums corresponding to 20 inches of mercury.

Possibilities and Limitations of the Marform Process

By HENRY P. HESSLER and J. E. BRODERICK
Glenn L. Martin Co., and
FRED C. YOUNG, Hydropress, Inc.

A PREVIOUS article on the Marform process, in May MACHINERY, described the use of a rubber cushion or pad, in conjunction with precisely controlled hydraulic pressure, for forming and drawing parts of various materials and shapes. The results of the control of pressure and the relationship between material and depth of draw were also discussed. The present article gives further information on the process, including the formability of various materials and shapes, shearing and trimming, tooling, etc.

The degree of formability of various metals, based on the use of Marform equipment operating at 6000 pounds per square inch pressure, is indicated in Table 6. It will be noted that a base rating of 100 for 2S–O aluminum is used. Higher pressures will increase the rating number on hard materials. The workability of material of various shapes has little or no significance as far as investigations have shown.

The forming radius is affected by the blank size, depth of draw, the material and its thickness, the flange left on the part after forming,

Table 6. Comparative Formability Ratings of Various Metals, Using the Marform Process*

2S-O Aluminum	3S-O Aluminum	61S-O Aluminum	52S-O Aluminum	R301S-O, 75S-O, 24S-O, 14S-O Aluminum	R301-W, 75S-W, 24S-W, 14S-W Aluminum (As Quenched)
100	95	92	80	75	60
2S-1/4H Aluminum	2S-1/2H Aluminum	3S-1/4H Aluminum	3S-1/2H Aluminum	52S-1/4H Aluminum	52S-1/2H Aluminum
50	40†	45	35†	40	30†
1010 Deep-Drawing Steel	1010 Commercial Steel	Stainless Steel Type 302	Stainless Steel Type 304	Stainless Steel Type 321	Stainless Steel Type 347
75	70	49	46	43	40
Soft Copper		Soft Brass		Hot-Formed Magnesium	
75†		70		95†	

*Ratings are based on 100 for 2S-O aluminum formed at 6000 pounds per square inch.
†Tentative.

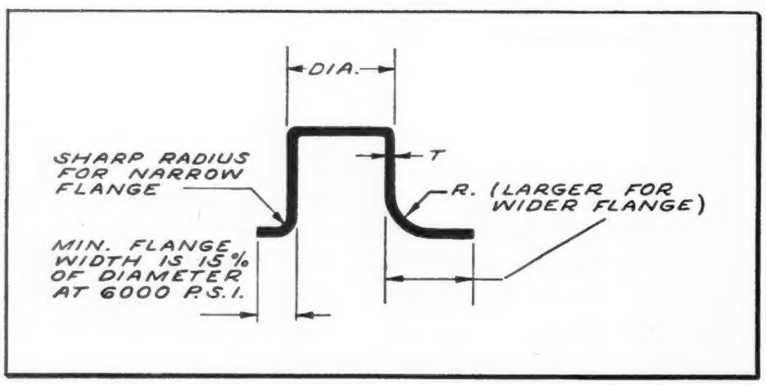


Fig. 5. Small residual flanges permit sharp forming radii, while large flanges require larger radii. At 6000 pounds per square inch forming pressure, the minimum flange width is 15 per cent of the cup diameter

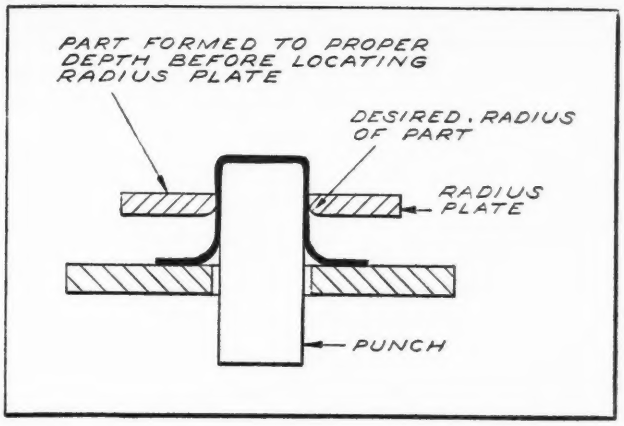


Fig. 6. Radius plates are often used in secondary operations when it is necessary to obtain very sharp radii

and the shape of the part. For a round cup, the sharpest radius possible is obtained when the residual flange is narrow. In general, the smaller the flange, the sharper the forming radius, as indicated in Fig. 5. Cup-forming tests made at 6000 pounds per square inch rubber-pad pressure indicate that the minimum flange radii, in terms of the material thickness *T* should be as given in Table 7.

In drawing boxes or similar shapes, the forming radius cannot be as sharp at the corners as along the straight sides. At the intersection of the vertical side wall with the flange, the forming radius will be slightly smaller than the minimum bend radius recommended for all materials,

Table 7. Minimum Flange Radii in Terms of Stock Thickness (T)

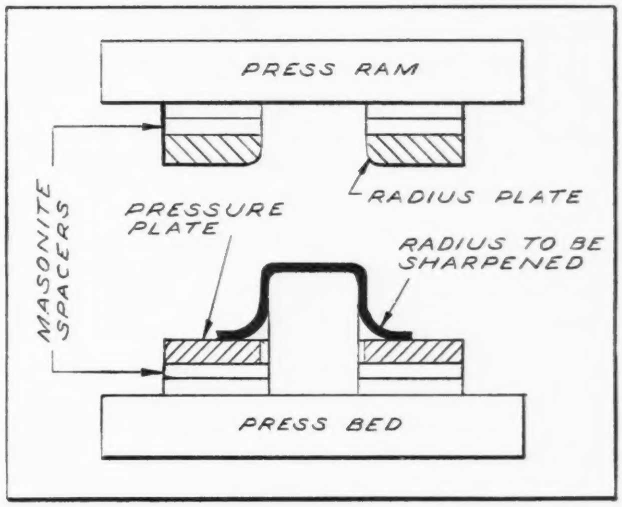
Material	Minimum Flange Radius
Aluminum	
2S-O, 3S-O	1 1/2*T*
52S-O, 61S-O	2*T*
24S-O, 75S-O	3*T*
24S-W (Heat-Treating)	4 1/2*T*
Steel	
SAE 1010 (Deep-Drawing)	4*T*
Stainless	8*T*

Note: This data is based on cup forming tests made at 6000 pounds per square inch rubber pad pressure.

with the exception of stainless steel, which is approximately 4*T*.

When parts are being made that require sharper forming radii than is practical to produce in one Marforming operation, particularly when sharp radii must be formed in stainless

Fig. 7. Typical restriking set-up used when a very sharp radius is required in a formed part



steel, it is necessary to restrike the part in a second operation on another press. The same Marform tools may be used, but a radius plate and mounting spacers are added. Figs. 6 and 7 show this set-up as it is used for typical parts.

Restrike operations are necessary in forming stainless-steel cups when the pressure is 6000 pounds per square inch and the forming radius is less than 8*T*, if the maximum draw is desired. Generally speaking, a radius plate is not required for forming aluminum-alloy cups or boxes having a flange. The forming radius is usually in accordance with specifications, or sharper; the latter condition is not objectionable on most parts. On aluminum and deep-drawing steel, the forming radius can be controlled to some extent by slightly varying the rubber pressure at the bottom of the stroke. Radius plates have been used on aluminum in some cases when the desired radius is sharper than normal.

The punch radius for cups depends upon the material to be formed, its thickness, and the ratio of depth of draw to the plan view dimen-

Table 8. Safe Minimum Punch Radius Relative to Material Thickness (T) for Forming Cups

Ratio of Draw Depth to Draw Diameter	Steel		Aluminum	
	SAE 1010	Stainless Types 302, 304	2S-O, 3S-O, 52S-O and 61S-O	24S-O, 14S-O, 75S-O and R301S-O
1/4	1/2*T*	2*T*	1*T*	2*T*
1/2	1*T*	—	2*T*	3*T*
3/4	2*T*	—	3*T*	4*T*
1	—	—	4*T*	—

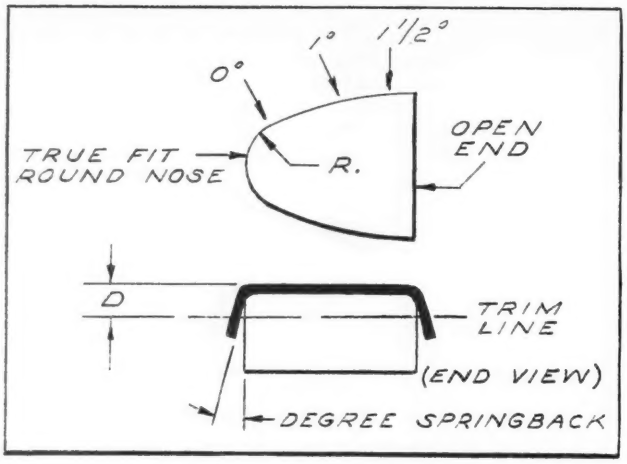
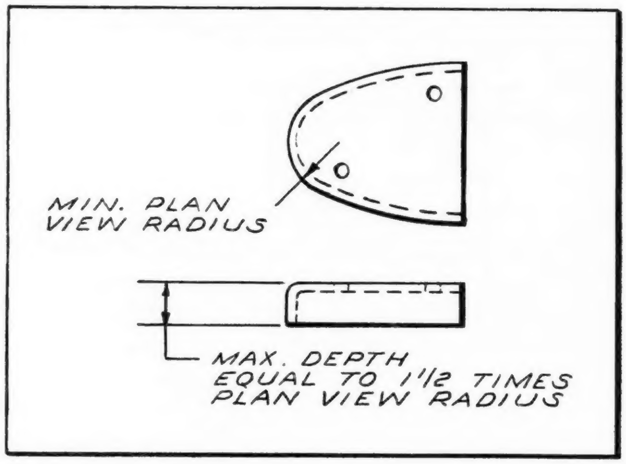


Fig. 8. Diagram indicating approximate angle of springback that occurs at various points when forming shallow open-end parts

Fig. 9. When forming such parts as aircraft nose ribs, the maximum depth of flange is one and one-half times the plan view radius



sions of the part. The deeper the draw for any given blank size, the larger the punch radius must be to prevent fracture of the part. The minimum recommended punch radius for forming cups is given in Table 8 in terms of material thickness T for various ratios of depth of draw to diameter of drawn part.

Springback—the tendency of a formed part to resume a shape other than that drawn, due to insufficient working of the metal—can be compensated for by under-cutting the punch. It is particularly noticeable on very shallow open-end parts, such as airplane nose ribs and frames, where the flange to be formed is small and the plan view radius or contour is large.

To aid in determining the degree of punch under-cutting required for drawing various materials, Table 9 has been compiled. This shows the approximate angle of springback for different percentages of draw depth, based on the formula $P = \frac{D}{R}$, in which P = percentage of draw depth, D = depth of draw, and R = plan view radius, as shown in Fig. 8. The values in this table are only approximate, and cannot be taken as final until additional tests are made.

As may be seen in Fig. 8, the springback only occurs at the open end, and gradually tapers to zero toward the most severely shrunk area. The more the shrinkage on the flange of parts that are Marformed, the closer the part will fit the punch. Even if the punch is not under-cut to allow for springback, the hand work required is very slight because of the ease with which the flange can be pushed back to the proper bevel. Often the flange can be reworked without the use of any tools.

For forming aircraft nose ribs and similar parts, the maximum depth of flange is 1 1/2 times the plan view radius, Fig. 9. This ratio applies to the heat-treatable aluminum alloys in the "as quenched" condition and softer, with a minimum metal thickness of 0.020 inch.

Table 9. Approximate Angle of Springback in Shallow, Open-End Parts Made of Various Materials

Aluminum 2S-O, 3S-O, 61S-O		Aluminum 52S-O, 24S-O, 14S-O SAE 1010 Steel and Stainless Steel		Aluminum 24S-W, 61S-W, 75S-W (As Quenched)	
Percentage of Draw Depth P	Angle of Springback (Degrees)	Percentage of Draw Depth P	Angle of Springback (Degrees)	Percentage of Draw Depth P	Angle of Springback (Degrees)
30	0	50	0	50	0
20	1/2	40	1/2	40	1
10	1	30	1	30	2
..	..	20	2	20	3
..	..	10	3	10	5

Note: Based on percentage of draw depth P equal to ratio of depth of draw to plan view radius, Fig. 9.

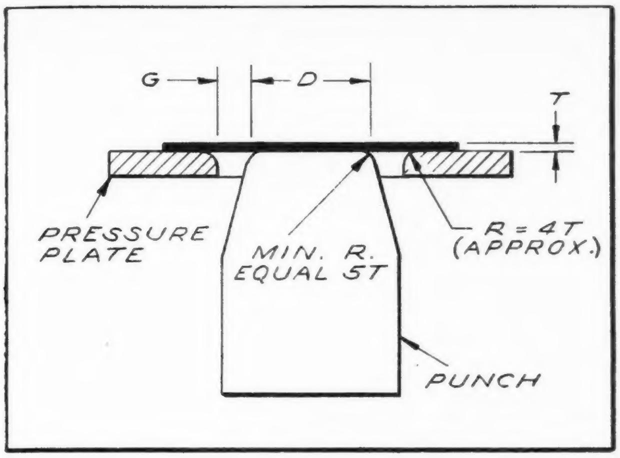
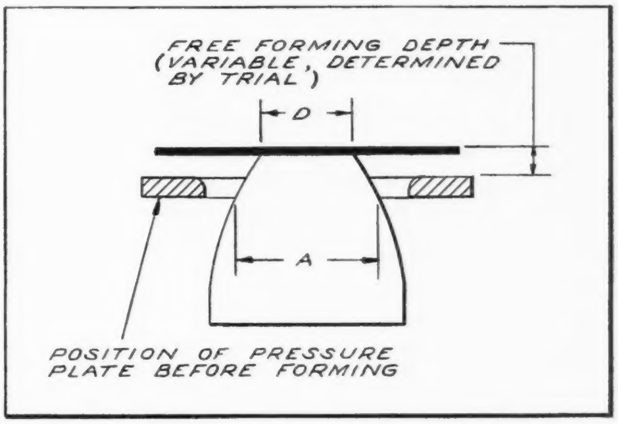


Fig. 10. For forming tapered cups, the gap (G) between the pressure plate and the top of the punch is directly proportional to the tensile strength of the material and its thickness (T), and is inversely proportional to the rubber-pad pressure required

Fig. 11. For forming convex tapered shapes, as shown, the part can be drawn much deeper than the small diameter of the punch due to "free forming" permitted prior to the actual build-up of pressure in the rubber pad



In forming tapered shapes, there is a limitation as to the size of the gap G (Fig. 10) between the top of the punch and the edge of the pressure plate. If the metal is thin and this gap is too great, the rubber-pad pressure will tend to shear the material that is not supported by the punch or pressure plate. Consequently, gap should be directly proportional to the tensile strength of the material and its thickness, and inversely proportional to the rubber-pad pressure required. The size of gap depends also, of course, upon the shape of the tapered part.

The maximum permissible gap G is given as a percentage of the minimum punch diameter D in Table 10 for various thicknesses of aluminum and steel. These figures apply to the formation of round cups, as indicated in Fig. 10. When the conditions shown in Table 10 are conformed to, the maximum draws possible are as given in Table 11. These limits are based on the use of 6000 pounds per square inch rubber-pad pressure. It is certain that if more pressure were exerted on the part, the depth of draw could be increased and all of the material left on the pressure plate would be pulled in without wrinkling the flange.

For forming a convex tapered shape, the depth of the part compared to the small diameter of the punch is radically different than for a straight taper. In forming tapered shapes such as shown in Fig. 11, the part can be drawn much deeper than the small diameter of the punch. This is possible because of the amount of "free forming" permitted prior to the actual building up of pressure in the rubber-pad. The maximum blank size possible is then equal to 2.34A rather than 2.34D.

Concave tapered parts, as shown in Fig. 12, present a difficulty because the gap G is sustained for a large part of the draw. While we have not had experience with this shape, it ap-

Table 10. Maximum Permissible Gap between Top of a Drawing Punch and Edge of a Pressure Plate when Drawing Tapered Shapes

Metal Thickness (Inch)	Maximum Gap, in Percentage of Minimum Punch Diameter	
	Aluminum	Steel
0.025	7 1/2	10
0.032	10	15
0.040	12 1/2	20
0.051	15	25
0.064	17 1/2	30
0.072	20	35
0.081	22 1/2	40
0.091	25	45
0.102	27 1/2	50
0.125	30	55

Table 11. Recommended Depth of Draw Relative to Punch Diameters for Tapered Parts of Various Materials*

Material	Specification	Permissible Depth of Tapered Part
Aluminum	2S-O, 3S-O, 61S-O	1×Punch Diameter
Aluminum	52S-O, 24S-O, 75S-O	3/4×Punch Diameter
Steel	SAE 1010 Deep-Draw	3/4×Punch Diameter

*Based on a forming pressure of 6000 pounds per square inch.

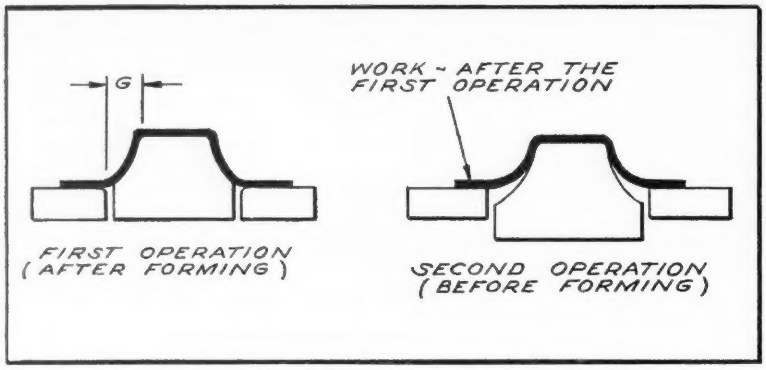


Fig. 12. Drawing concave tapered parts is difficult because the gap (G) is sustained for a large part of the draw. Often two or more forming operations are necessary

pears as though two or more draws would be necessary under certain conditions.

The maximum thickness of material that has been sheared by the Marform process is 0.040 inch on 24S–O aluminum or softer. The approximate pressure required for shearing this material was 3000 pounds per square inch. When an attempt was made to shear thicker material, the metal tore, leaving a burr and an irregular edge. Varying the pressure did not help this condition; however, it is believed that a different design of punch and shear edge would enable heavier gage aluminum to be sheared with a clean edge and experiments are being conducted toward that end.

The Marform tools consist of a pressure plate and a punch that may be made of cast Kirksite, Masonite, plastic, or steel. Masonite or plastic is utilized in the manufacture of the punch when the plan view curvature of the shape to be formed is generally not greater than one-half the depth of the part, and when there are no more than 200 pieces to be formed. Such punches can be used only for forming aluminum alloys in the soft condition.

In most cases, steel is employed. The steel punch should be hardened when either soft or hard materials are formed in quantities greater than 1000. Cast Kirksite is used for the punch when there are no thin projections on the tool and when the machining cost of making Masonite or steel punches would be excessive for the quantity involved. A good example of the use of Kirksite tooling is found in the manufacture of airplane exhaust stacks.

The pressure plate is usually made of steel, and it must be ground on the surface in contact with the blank. Normally this plate can be cut with a saw and finished by a file on the inside opening. The outside perimeter may be cut by a machine torch in most cases. When the pressure plate is greater in size than the facilities available for grinding the surface in contact with the blank, a 1/8-inch smooth steel overlay may be attached. This steel overlay should be fastened to the steel plate at the four corners by screws.

Cast Kirksite is employed in the manufacture of a pressure plate only when the shape of the part is other than flat. The Kirksite should be not less than 1 inch thick and must always be backed up with a 1/2-inch steel plate. The two portions of the pressure plate must then be doweled or screwed together.

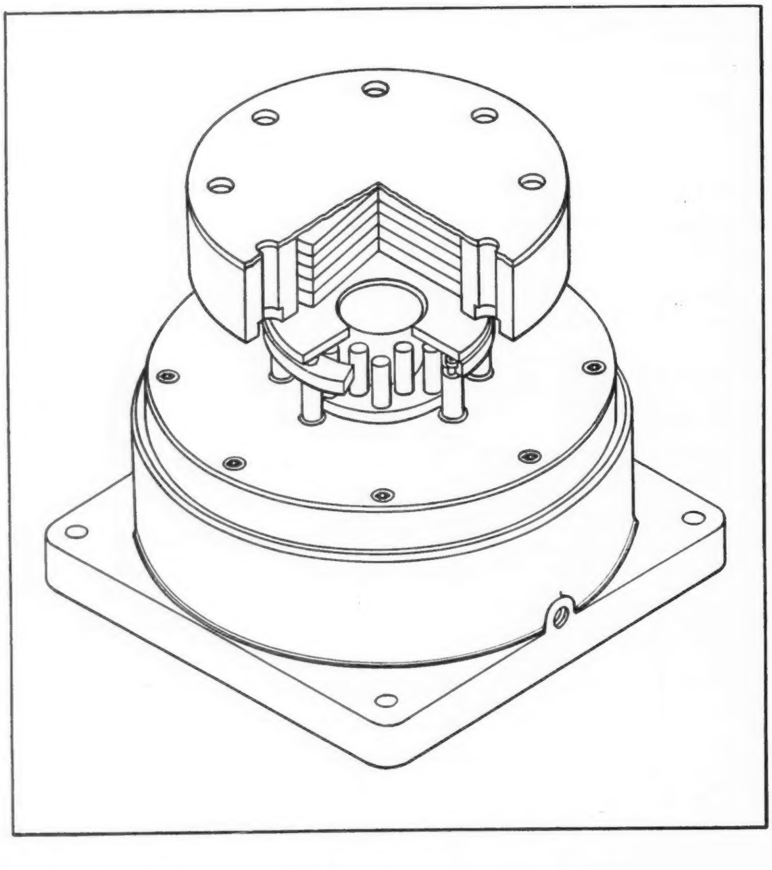


Fig. 13. Diagram of the Marform unit, showing the form block, pressure plate, seal ring, and pressure pins

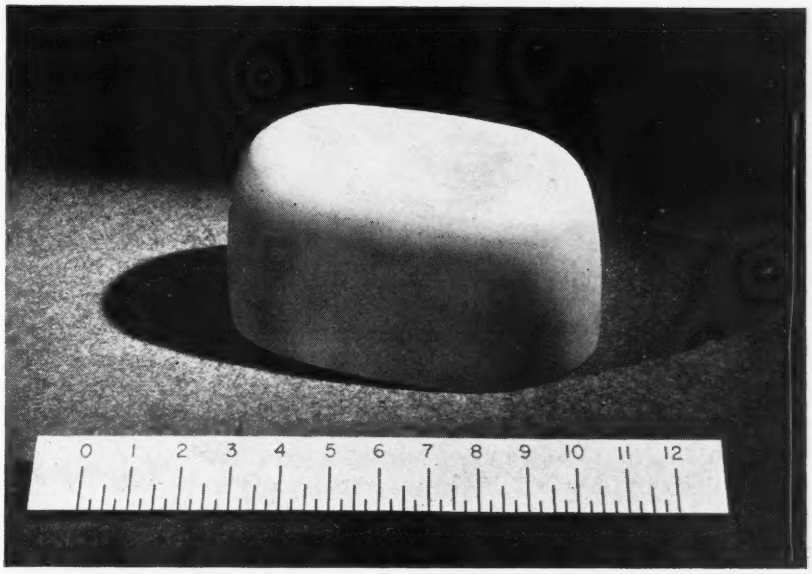


Fig. 14. Typical Marformed part, made of S A E 1010 deep-drawing steel which is drawn to a depth of 5 inches at the rate of 22 seconds per part

The Marform punch, which is similar to the punch of a steel drawing die and conforms to the shape of the part, is very easily attached to the machine. For forming parts of closed shape, provision has been made to fasten the tool to the base of the machine through a very simple bayonet type locking arrangement. For most other parts, the tool is placed on the base of the machine without a hold-down plate. The pressure plate is placed over the tool and rests on the seal ring and pressure pins, as shown in Fig. 13. It is not necessary to attach the pressure plate with screws or bolts in most cases.

In Marforming, the blanks are lubricated with a soap compound, applied by either brushing or spraying. This simplifies the cleaning problem, as the part merely has to be immersed in water to remove the lubricant, whereas with oil lubricants, it is necessary to have some sort of chemical cleaner.

It has been found that the production of parts by the Marform process is economical for quantities ranging from 4 to as many as 80,000 pieces. Fig. 14 shows a toaster shell which was produced in large quantities. The material is 0.030 inch thick, S A E 1010 deep-drawing steel. The depth of the part is 5 inches, and the time required was 22 seconds per part. The Marform process can be used advantageously in the following fields:

1. Aircraft manufacturing where the rubber-sheet process is now used and where it is desirable to reduce hand straightening operations. In this field, it is also employed where the costs of conventional drawing dies would be too high for the production requirements.

2. Manufacture of copper, aluminum, and stainless-steel cooking utensils where the depth of draw is half the diameter of the finished product or greater, and where it is essential to preserve the surface finish of the work during the drawing operation.

3. Lighting fixture manufacture having the same requirements as those mentioned in the previous classifications.

4. Any industry in which the tool cost is excessive.

All of the data presented in this article has been based on equipment in use at the plant of the Glenn L. Martin Co. For this reason, the limitations given in the tables apply only to Marform units having a maximum forming pressure of 6000 pounds per square inch. With pressures up to 10,000 pounds per square inch, which are available in the standard series of Hydropress Marform package units and presses, the forming limits would be greatly improved.

* * *

Foundry Society Plans National Technical Center

The American Foundrymen's Society announces that a program has been adopted to found a technical center for the producers of cast metals vital to the nation's rearmament program. It will be established during the next two years in one of the principal midwestern foundry centers.

The headquarters of the Society have been located in Chicago since 1916. The selection of a site for a technical center and permanent headquarters will be made by a special housing committee of foundry executives. The enlarged facilities and services contemplated by this program will materially aid the foundry industry to meet the demands of the Armed Forces in the new emergency.

Engineering News

Large Permanent-Mold Aluminum Casting Weighs 500 Pounds

A permanent-mold aluminum casting weighing 500 pounds has been successfully produced at the John Harsch Bronze & Foundry Co., Cleveland, Ohio. Although the total production run on this part is small, the permanent-mold method costs only a fraction of what it would to produce the part by sand casting. The illustration shows a completed casting ready to be ejected from the mold.

Originally the company cast the part in sand. Because of the large size of the unit, this operation occupied four bays in the foundry. Also, the use of a large sand slinger was required in preparing the molds, and seven men could produce only four units a day. The large number of iron "chills" required in the mold resulted in a rough surface that was very difficult to machine.

To produce the unit as a permanent-mold casting, a mold of cast Meehanite, weighing nearly 10 tons, was constructed. The mold is 65 inches high and has an average diameter of about 46 inches. It is constructed of hinged sections which ride on rollers to facilitate opening and closing. Rows of gas burners surrounding the mold maintain it at uniform temperature for optimum pouring conditions.

Not only does the permanent-mold method produce castings of higher strength than the sand castings, but also smoother surfaces, which are much easier to machine. Only one bay in the foundry is required for the permanent-mold operation, and four men can produce twelve units a day.

Thickness of Tin Coating Measured to within 0.0000006 Inch

Less than 0.0000006 inch is the extreme degree of exactness that has been demonstrated by a new tin-plate coating thickness gage devised by the research laboratories of the United States Steel Co. to save tin while assuring an adequate coating. This gage is capable of measuring various thicknesses of tin coatings for different kinds of cans with a precision of approximately 1 per cent.

Measurement of the tin coating is made by exposing a sheet of tin plate to an X-ray beam for a short interval and, at the same time, measuring with a Geiger counter the secondary rays reflected by the steel beneath the tin coating. The tin traps some of the secondary X radiation. That which reaches the counter has been found to be in inverse proportion to the thickness of the tin coating.

In practical operations, tin-plate thickness gages of this design are already in use in the tin mills. Measurements of minute coating thicknesses are made simultaneously on both sides of

Completed aluminum casting, weighing 500 pounds, ready to be ejected from the Meehanite permanent mold

a tin-plated sheet. The sheet is placed on a table between two X-ray gages, one above and one below the sheet. A button is pressed to start the gages. Thirty seconds later the gages shut off automatically. The precision readings of coating thicknesses are printed on moving paper tapes.

The combination X-ray Geiger-counter gage offers three important advantages over earlier chemical methods of measuring tin coatings—it is faster; more accurate; and does not destroy or mar the tin plate.

New Glass-to-Metal Sealing Method Developed by General Electric

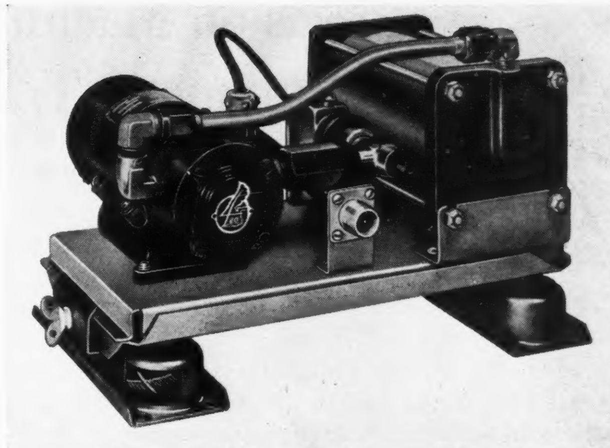
Engineers of the General Electric Co. have developed a method of soldering glass to metal by a process which makes a bond stronger than the glass itself. This new method, which can also be used to solder metal to ceramics and carbon, is being tested for industrial applications by the company's engineering laboratory.

The glass and metal areas to be soldered are painted with a thin layer of titanium hydride, and solder is placed on both painted areas. The parts are placed together and then heated under a vacuum. When the temperature reaches about 900 degrees F., the titanium hydride decomposes. This causes the molten solder to adhere to the titanium-painted areas of both glass and metal, forming a strong bond upon cooling.

By using soft metal solders, it is possible to subject this glass-to-metal seal to rapid temperature changes without danger of cracking, despite the wide difference in temperature expansion of glass and metal. This is possible because the differences in movement are absorbed by the solder. The new technique is now in use in aircraft ignition systems, and laboratory investigations have suggested possible applications in the manufacture of transformers, capacitors, and electric motors.

Compact Unit for Maintaining Sea Level Pressure at High Altitudes

A new panel-mounted pressurizing unit, manufactured by Lear, Inc., Romec Division, Elyria, Ohio, automatically pumps oil- and water-free air into pressurized sections of radar or other electronic parts of aircraft to enable such equipment to operate under sea level pressure at altitudes of from 35,000 to 50,000 feet. This unit, mounted to resist shock, requires less than 1/4 cubic foot of space and weighs only 7.5 pounds. It has a service life of 1000 operating hours and



Compact unit designed to maintain sea level pressure in aircraft equipment at high altitudes

is fully equipped with absolute pressure switch, combination inlet air filter and dehydrator, and outlet check-valve.

The continuous-duty, 1/15-H.P., direct-current motor is rated at 27 volts, 3 amperes at sea level or 6 amperes at maximum altitude and at a temperature of minus 67 degrees F. The pump capacity is well over 900 cubic inches of air per minute at sea level and 80 cubic inches per minute at 35,000 feet.

Auxiliary Power Source for Guided Missiles

An auxiliary power source for guided missiles incorporating a tiny 60,000-R.P.M. axial-flow turbine has recently been developed by the AiResearch Mfg. Co., of Los Angeles, Calif. About the size of a milk bottle, this unit develops power equivalent to that required to operate all the lights, hoists, air outlets, and other equipment in a super service station.

As a secondary source of power in a guided missile, it will operate such vital elements as stabilizers and air surface and guidance controls during its supersonic flight. The complete unit consists of a partial admission axial-flow turbine, a reduction gear-box, a 12,000-R.P.M. induction generator, and a gear type hydraulic pump.

In operation, hot gases ignited in the gas generator drive the turbine wheel that produces power for the shaft. The alternator and the hydraulic pump convert the shaft power into electrical energy and hydraulic power. This compact unit, exclusive of the gas generator, is 6 inches in diameter by 11 inches long, and weighs 16 pounds. Its rugged construction enables it to withstand the severe acceleration, shock, and vibration loads imposed by missile operation.

Precision Machining of Studebaker Automatic Transmission Parts

(Continued from page 156)

ing. At the sixth station, the small bore in the forging is finish-machined and chamfered, and the small-diameter end is chamfered by tools held in a boring-bar on the main slide. Tools at the seventh station finish-form the external angular groove and trepan the internal recess. The small-diameter end of the planet carrier is finish-faced and the internal recess finish-trepanned at the eighth and final machining station.

The forgings are rotated at 343 R.P.M., which corresponds to a cutting speed of 360 feet per minute on the 4-inch diameter of the work. All the tools, with the exception of those used for trepanning, are tungsten-carbide tipped. The high-speed steel trepanning tools are rotated by a separate driving unit. All tools mounted on the main end slide, except the trepanning tools at the eighth position, are fed by cams at the rate of 0.0045 inch per revolution. The trepanning tools at the last station are fed at 0.0026 inch per revolution. The rate of feed for all tools on the cross-slides is 0.0083 inch per revolution. Three sets of sharpened tools, mounted in their respective holders or bars, are kept in readiness for use when replacements become necessary, so that machine "down" time is reduced to a minimum.

Three slots that provide clearance for the gears in the rear planet carrier are milled on the special Cross machine shown in Fig. 12. The slots, milled in the solid steel forging (S A E 1141) are 1 1/8 inches deep by 1 1/16 inches wide. Two cutter-spindles are provided for milling two forgings simultaneously.

The machine is also equipped with a two-station, four-spindle, rotary table, which permits loading and unloading two parts while two other parts are being milled. The table rotates in a horizontal plane, through an angle of 180 degrees, at the end of each machining cycle. During the machining cycle, the two work-holding spindles in the cutting position (at the rear of the table) are automatically indexed through a 120-degree angle. A fluid motor drive is provided for rotating the table and indexing the work-spindles. The rotary table is clamped in position by a gravity-operated cam.

The staggered-tooth, helical milling cutters used for this operation are 4 1/2 inches in diameter. They are rotated at 150 R.P.M. and fed downward hydraulically at the rate of 0.050 inch per revolution. The sixteen-tooth, high-speed steel milling cutters have a 12-degree helix angle, a 7-degree primary clearance angle, and a 10-degree secondary clearance angle. A soluble oil, mixed with water in the ratio of 1 to 10, is flooded on the cutters during milling. Eighty-five planet carriers are slotted per hour.

American Type Founders, Elizabeth, N. J., are now manufacturing the 76-millimeter gun that will arm the new General Walker Bulldog 25-ton tank being made by the Cadillac Division of General Motors Corporation. With appropriate ceremonies, the first unit was delivered to the Army early in April. Thomas Roy Jones, president of Daystrom, Inc.—parent company of American Type Founders — is shown inserting a shell into the breech of the new weapon before a group consisting of Colonel E. S. Mathews, chief, Artillery Branch, Industrial Division; Colonel John S. Walker, deputy district chief, New York Ordnance District; Major General A. B. Quinton, special assistant to chief of ordnance; Alfred E. Driscoll, governor of New Jersey; and Edward G. Williams, president, American Type Founders

New Process for Producing Holes in Hard Metal

Holes, Recesses, or External Contours of Various Shapes can be Quickly Formed in Carbide or Other Hard Materials by Means of an Outstanding New Method. The Process Involves the Use of a Rapidly Vibrating Tool Operating in a Mixture of Water and Abrasive

By A. KURIS
Cavitron Equipment Corporation
New York City

THREADING, drilling, or forming of various internal or external shapes in the hardest materials can be performed quickly and accurately by a new method, known as the Cavitron process. In this process, boron-carbide abrasive, mixed with water, is directed on a blunt-end tool having a cross-section of the same shape as that to be produced, which is rapidly vibrated against the surface of the work. This vibration, or pulsation—actually a periodic expansion and contraction of the tool—causes the hard abrasive particles to be forced against the work surface, thus removing minute particles. The tool tip vibrates at the rate of 27,000 times a second, and the amplitude of the vibration—or stroke—is from 0.001 to 0.002 inch.

Hard materials that have been difficult or impossible to machine in any other way are successfully "cut" by this method. Originally developed about five years ago to cut sapphires, rubies, and diamonds for the jewelry trade, the Cavitron process is now being applied with success in the metal-working field. Fully sintered carbides and borides, hardened tool and die steels, Stellite, Alnico, and some of the newer heat-resistant, jet-engine alloys have been formed in this way.

The simple and compact set-up employed, as seen in the heading illustration, makes use of a magnetostriction oscillator with an electromechanical resonant circuit. Alternating current—110-volt, 60-cycle—is supplied to the 27-kilocycle electronic oscillator shown at the right.

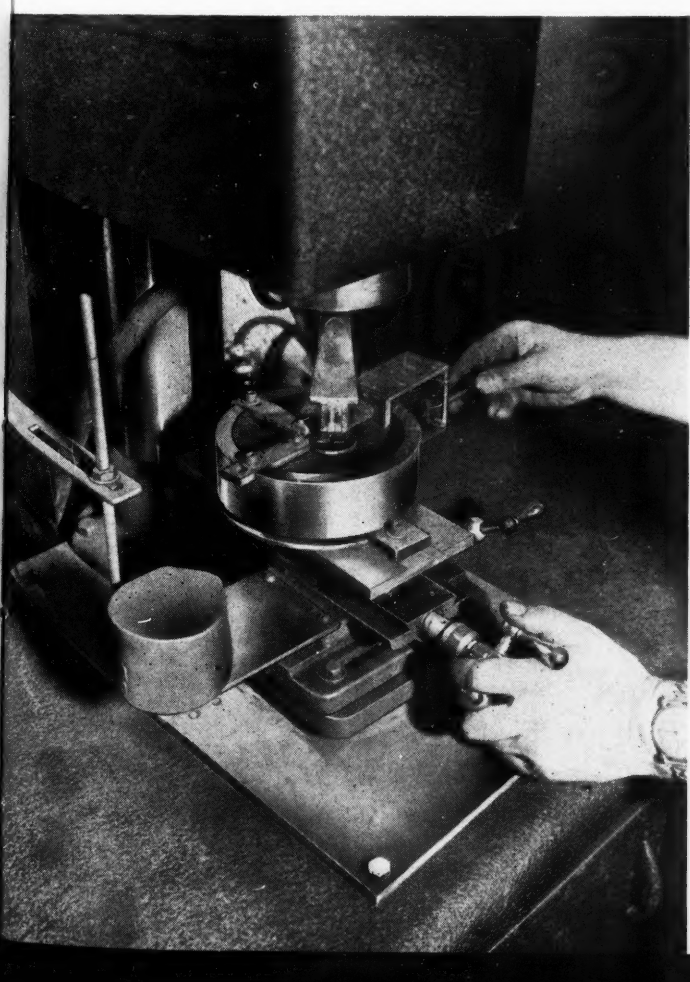


Fig. 1. A blunt-end tool, vibrating 27,000 times per second and operating in a mixture of water and boron-carbide abrasive, is used to cut through hard materials

The high-frequency current from the oscillator regularly increases and decreases the flux in a magnetic field around a nickel rod mounted at the upper end of the tool.

This high-frequency magnetic field intermittently contracts and expands the nickel rod, thus causing it to lengthen and shorten at the high speed of 27,000 times per second. The steel cutting tool, being screwed to the lower end of the nickel rod, reciprocates vertically at the same rate. Such a rapid rate of vibration imparts to the tool an acceleration approximately 70,000 times that caused by the force of gravity.

The machine in which the tool is used (Fig. 1) is a modified bench drill with means for feeding the work upward against the vibrating tool. The work-piece is held in a three-jaw chuck, which can be moved both longitudinally and transversely for aligning the work with the tool. Other machines have been built to feed the vibrating tool down into the work.

The rate at which the tool penetrates the part will vary with the material being machined, the size of the hole or other shape being produced, the coarseness of the abrasive, and the accuracy desired. For example, about one-half hour is required to produce a 1/4-inch square hole in 1/4-inch thick carbide with a solid square tool. The same hole could be produced in less time with a tubular tool, and an even shorter time would be required to produce a round hole 1/4 inch in diameter.

To obtain smoother surface finishes and maintain closer tolerances, the penetration rate is reduced and finer mesh abrasive is employed. A 280-mesh or finer abrasive is used to produce smooth finishes on carbide, while a 240-mesh abrasive is employed for rougher finishes. The solution containing boron-carbide abrasive flows over the work and under the vibrating tool, and is recirculated by means of a pump in the base of the machine. Even in deep-hole "drilling," the abrasive works its way to the bottom of the hole, and the tool need not be retracted during the operation.

Holes and openings with diameters ranging from 0.007 inch to 2 inches can be formed to a tolerance of 0.002 inch. Even closer tolerances can be maintained by performing the operation in two steps—using a tool for roughing, followed by a tool that finishes the hole to the desired size. Since no appreciable heat is generated in this process, the microstructure of the work-piece remains unchanged.

The tools can be made from any tough malleable metal, such as cold-rolled steel, which is machined to the shape of the hole or recess to be produced in the work. Usually a shaped tip is brazed to the lower end of the steel tool, which, in turn, is screwed to the lower end of the nickel rod. Fig. 3 shows several carbide samples with odd-shaped holes produced by the process described. The tools used in each case are shown just above the work.

Successful applications of the process up to the present time include the engraving of lettering and numbering dies, the production of form cutters, die-sinking, the machining of oil-holes and keyways in hardened gears and gear-cutters, the manufacture of complex wire-drawing dies, the marking of hardened tools and dies, and the cutting of "Christmas tree" slots in the roots of heat-resistant alloy or ceramic buckets for jet-engine turbines. By rotating the work at the proper speed and feeding it at the correct rate, internal or external threads can be produced.

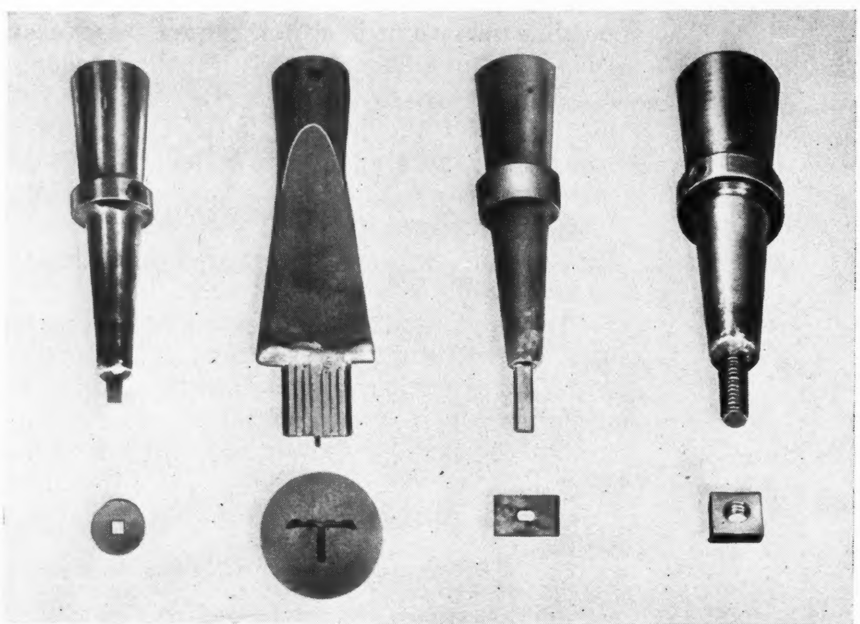


Fig. 2. Carbide samples, illustrating some of the odd-shaped holes that can be produced by the Cavitron process. Tips of the desired shape are brazed to the steel tools

Laminated Shims Reduce Production and Maintenance Costs

Methods Employed in Making Precision Laminated Shims of Various Sizes and Shapes, and Typical Applications are Described Here

By RICHARD SEIPT
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THE use of shims is no longer an indication of inability to design or produce accurately; on the contrary, their proper application is evidence of good engineering, because distinct advantages are gained by both the manufacturer and the user of the equipment in which they are placed. Laminated shims, designed to suit the individual requirements of manufacturers in the aircraft, automotive, machine tool, instrument, and other metal-working industries, considerably reduce the time required for precision machining, grinding, and fitting in assembly. Equipment having properly designed shims is easily and accurately adjusted when necessary without recourse to expensive disassembling and machining operations. Thus, maintenance problems are simplified to the extent that it is only necessary to remove a shim or two to make adjustments in adjacent members of a machine.

Typical applications of shims made by the Laminated Shim Co., Inc., Glenbrook, Conn., are shown in the accompanying illustrations. Fig. 1, for example, shows them being employed for adjusting the eccentric strap of a vertical steam engine, while Fig. 2 illustrates the crank bearings of a Diesel engine being adjusted by the use of shims. Precision spacing of the cutting tools for an automatic lathe is illustrated in Fig. 3, and in Fig. 4, shims are shown being inserted in the spindle bearings of a precision grinder.

One of the best and most inexpensive means of preloading ball bearings is to insert shims between the end cap and bearing housing faces, as shown in Fig. 5. This eliminates the need for the careful machining and grinding often re-

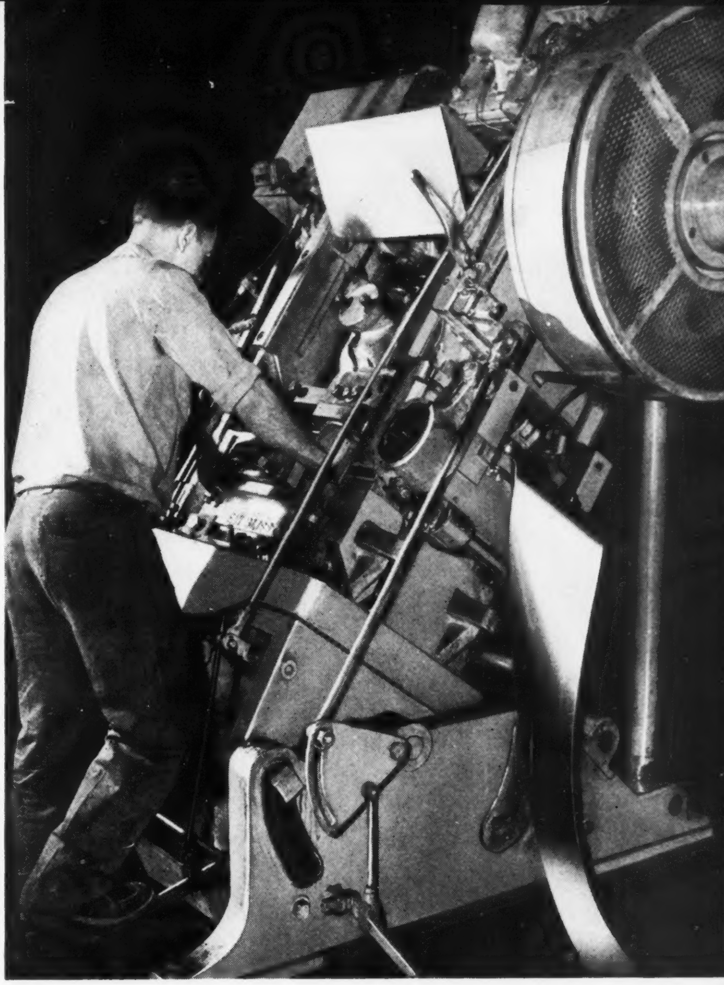

Fig. 1. "Laminum" shims are employed to provide adjustment in the eccentric strap of a vertical steam engine

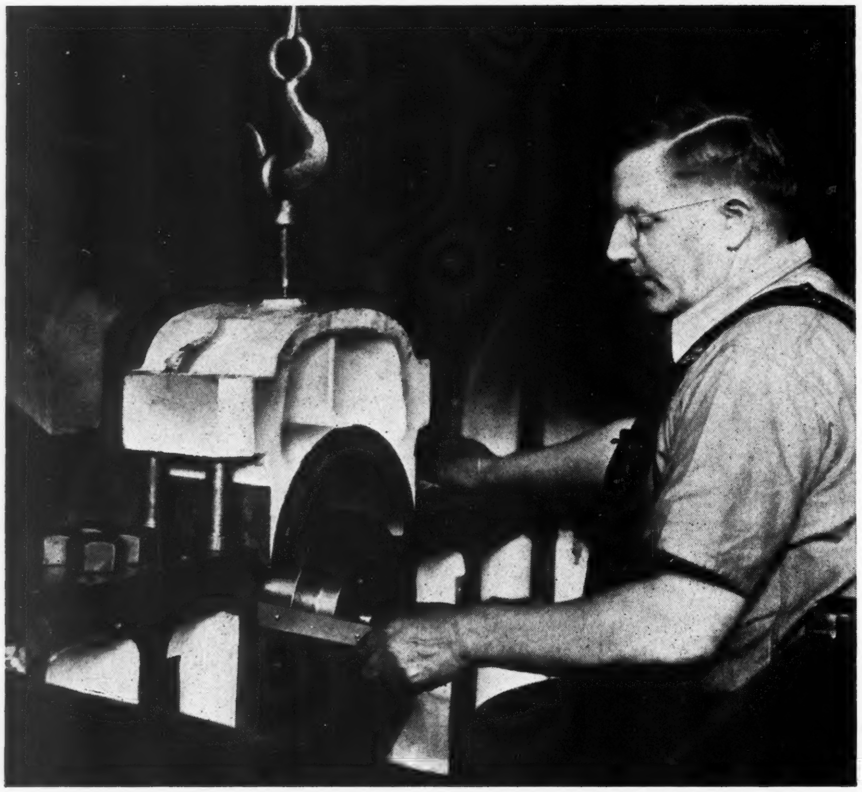

Fig. 2. Adjustment of Diesel-engine crank bearings is simplified by the use of shims designed especially for this installation

quired to assure perfect squareness between the bore of a bearing housing and the face of a threaded member that is tightened against the outer race of a bearing to apply an initial load. Gear spacing, to insure the proper mesh between teeth, is another typical application of precision-made shims.

Steel and brass shims are produced in this plant in a wide variety of sizes and shapes. The basic forms in which they are made include one-piece solid shims and "Laminum"* shims. The latter are made up of brass laminations, 0.002 or 0.003 inch thick, joined together with microscopic layers of a metallic binder so securely as to permit handling and working without loosening of the laminations. "Laminum" shims are, in effect, the same as a solid unit, with the added advantage of providing quick adjustment be-

*Registered trade name signifying an exclusive manufacturing process.

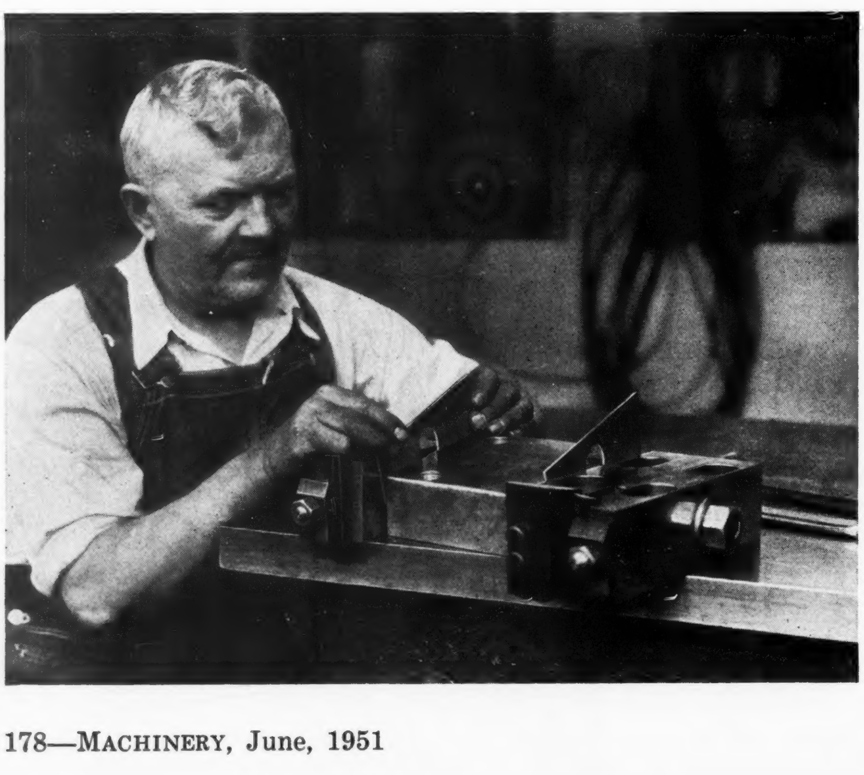

Fig. 3. The precise spacing of cutting tools for an automatic lathe is facilitated by the use of specially designed shims

Fig. 4. The use of "Laminum" shims in the spindle bearings of this precision grinder provides a means of making adjustments quickly by peeling laminations of known thickness from the shim

cause the laminations can be peeled off as desired. Thus, the user of equipment having these shims can make an adjustment by removing 0.002 or 0.003 inch (or multiples of these thicknesses) in precise layers from the original shim.

In another form of "Laminum" shims, produced in thicknesses from 1/16 to 3/16 inch, the central section is made of solid brass, and brass laminations are placed on both sides of the solid section. For use in split bearings where it is necessary to retain oil pressure, "Laminum" shims are also made with babbitt tips and faces anchored to them to avoid scoring the shafts.

In production, strips of commercial half-hard brass coil stock, either 0.002 or 0.003 inch thick, are laminated to form 8- by 48-inch sheets. The number of laminations depends, of course, upon the total thickness of shim required for a particular application.

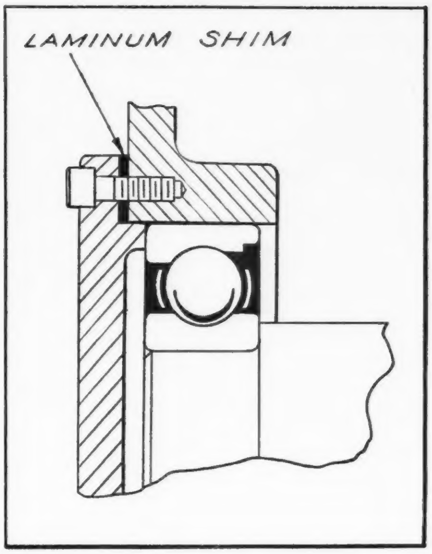

Fig. 5. Shims are used to preload ball bearings by inserting them between the end cap and housing faces

Conventional compound piercing and blanking dies are used extensively for producing shims from this stock. A large stock of standard tools is maintained for piercing holes that range from 0.066 inch to 5 inches in diameter. These tools consist of die-blocks having several holes to provide the various punch and die clearances necessary for different shim thicknesses. Several punches of varying sizes are, of course, provided for each die-block. Other tools maintained in stock include punches and dies for producing 90-degree radii at the corners of square or rectangular shims.

Precise hand sawing operations are employed to eliminate the cost of special dies for experimental jobs, pilot production runs, and other orders involving small quantities. An operation of this kind may be seen in Fig. 6, where a DoAll contour saw is being used for producing eighty-eight "Laminum" shims for pump connecting-rods. These shims are made up of thirty-one brass laminations, 0.002 inch thick, forming 1/16-inch stock.

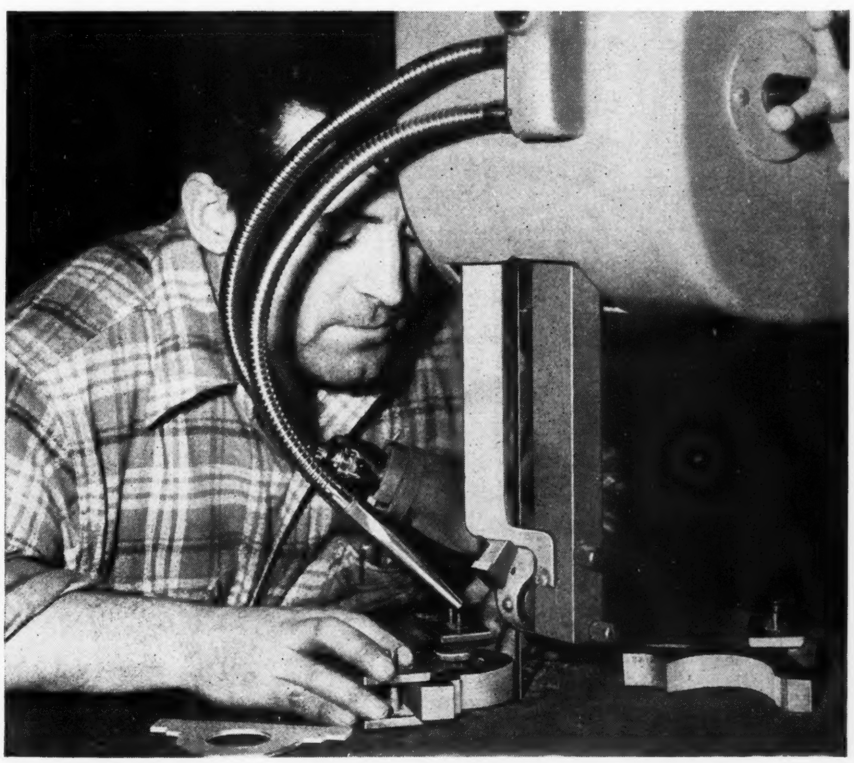

Fig. 6. Small quantities of shims having irregular shapes are produced by the use of contour saws

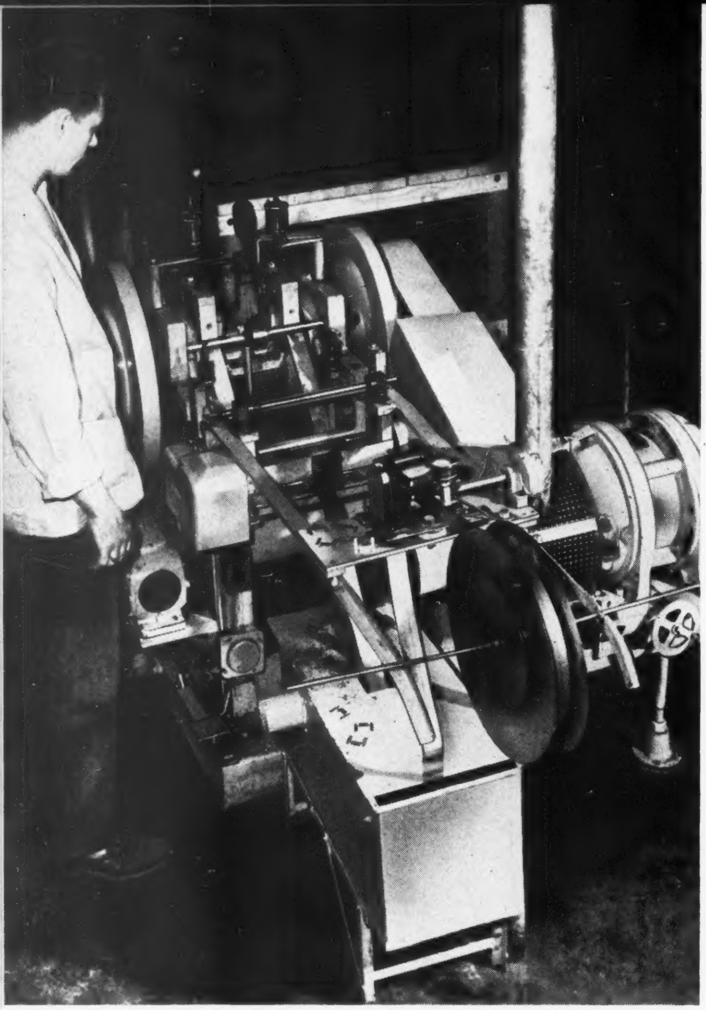

Fig. 7. Thin solid shims are made at high rates of production in this Super Speed press. The coil stock passes through a bath of carbon-tetrachloride to prevent the blanks from sticking together

In making the shims, the material is first sheared into rectangles large enough to allow stock for contour sawing. Then one of the rectangles is blued and the shim contour laid out on one side. This piece subsequently becomes the templet from which the others are made. Before sawing the rectangles to the desired shape, however, a center hole 1 9/16 inches in diameter, is pierced in each rectangle, using a set of the standard tools previously mentioned.

After the parts have been sawed to the required contour, burrs are removed and the completed shims are stacked and flattened.

In contrast with this method of producing small quantities of shims, the Super Speed press shown in Fig. 7 provides a fast means of meeting high-volume production requirements. The adjusting shim for a business machine, illustrated in Fig. 8, is a typical example of the parts produced in this press. The stock, 0.003 inch thick half-hard brass, is fed to the press from a reel, passing through a bath of carbon-tetrachloride before it enters the die, so as to prevent the thin stampings from sticking together. The die bed reciprocates so that the punch can enter the die without stopping the feed. Using one die, approximately 1000 of these shims are produced every minute.

Another interesting press set-up is illustrated in Fig. 9. Here 0.020-inch thick, 2S-O aluminum blanks are stamped in a 30-ton V & O punch press to form gaskets for the combustion chamber inlet ducts in turbo-jet aircraft engines. A compound die is employed, not only to insure producing flat shims, but also to avoid the use of long progressive dies. With each stroke of the press a finished gasket is produced, which represents a rate of 600 pieces per hour.

Over 10,000 shims per hour are produced in the 10-ton V & O press shown in Fig. 10. These "Laminum" shims, made for adjustments in automotive connecting-rods, are produced in a double progressive die, using stock 0.006 inch thick, made up of 0.002-inch laminations.

Solid cold-rolled steel shims, 0.020 inch thick, are made in another V & O press, as shown in Fig. 11. About 3000 of these shims are made per hour, using coil stock, which is fed to a compound die. An interesting feature of this set-up is the roller and conveyor arrangement at the back of the press, Fig. 12. As each shim leaves the die, it drops on the conveyor and is carried to the rollers, between which it is flattened to remove any small burrs that may be present. A vernier adjustment provides for controlling the pressure by separating the rollers in increments of 0.001 inch less than the thickness of the shim.

Another press in which shims are deburred in this manner is shown in the heading illustration. This is a 65-ton Bliss press, usually employed for

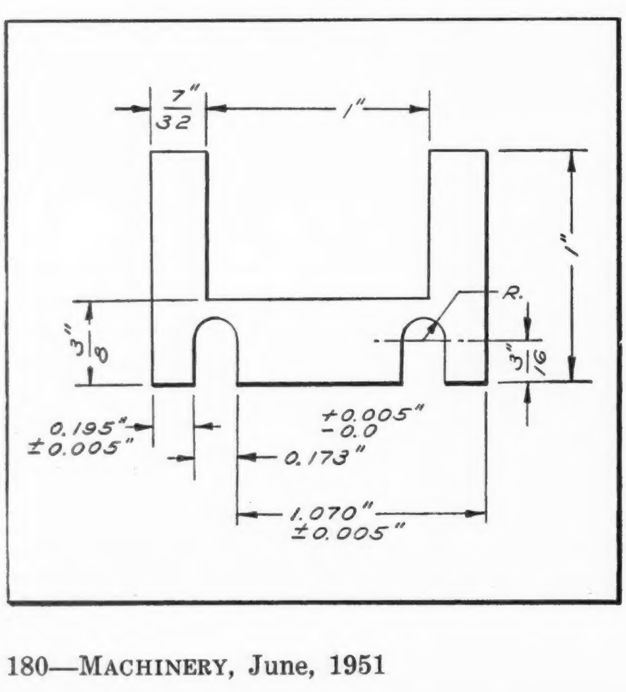

Fig. 8. This adjusting shim, used in an automatic business machine, is produced at the rate of 1000 pieces per minute in the press illustrated in Fig. 7

producing the larger sizes of shims. One typical job, for example, consists of a 1/8-inch thick shim, made up of sixteen brass laminations, 0.002 inch thick; one solid brass section, 1/32 inch thick; and ten other laminations each 0.006 inch thick. Each lamination is stamped separately from stock of the proper thickness, the laminations being assembled later and spot-soldered together. The production rate for this job is 2700 separate stampings per hour, amounting to 100 complete shims per hour.

Fig. 9. A compound die is employed in a 30-ton press to produce 0.020-inch thick 2S-0 aluminum gaskets for the combustion chamber inlet ducts of turbo-jet aircraft engines

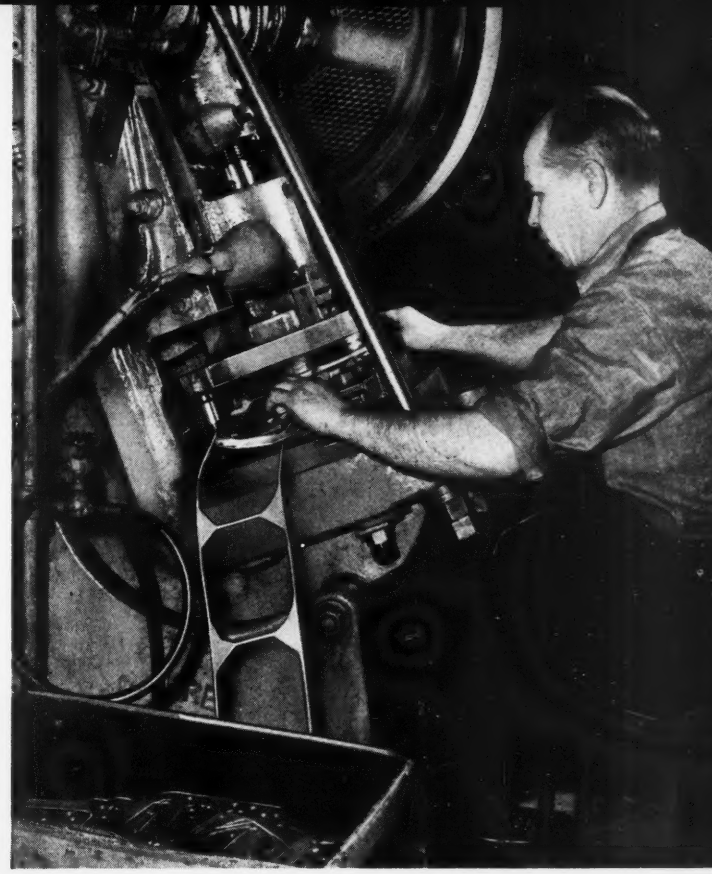

Fig. 10. Over 10,000 adjustment shims for automotive connecting-rods are produced every hou· in this double progressive die

Samples and short-run lots that do not require contour sawing are quickly produced by means of high-speed rotary shears and bench press operations. For example, "Laminum" or solid strips for round shims may be sheared by a die into squares slightly larger than the required diameter. By the use of special stops in a press, two sides of a square or rectangle are cut from the strip at one time. After the first piece is sheared, the rest are completed at each stroke of the press.

If center holes are required in the shims, they are pierced after shearing to provide a means

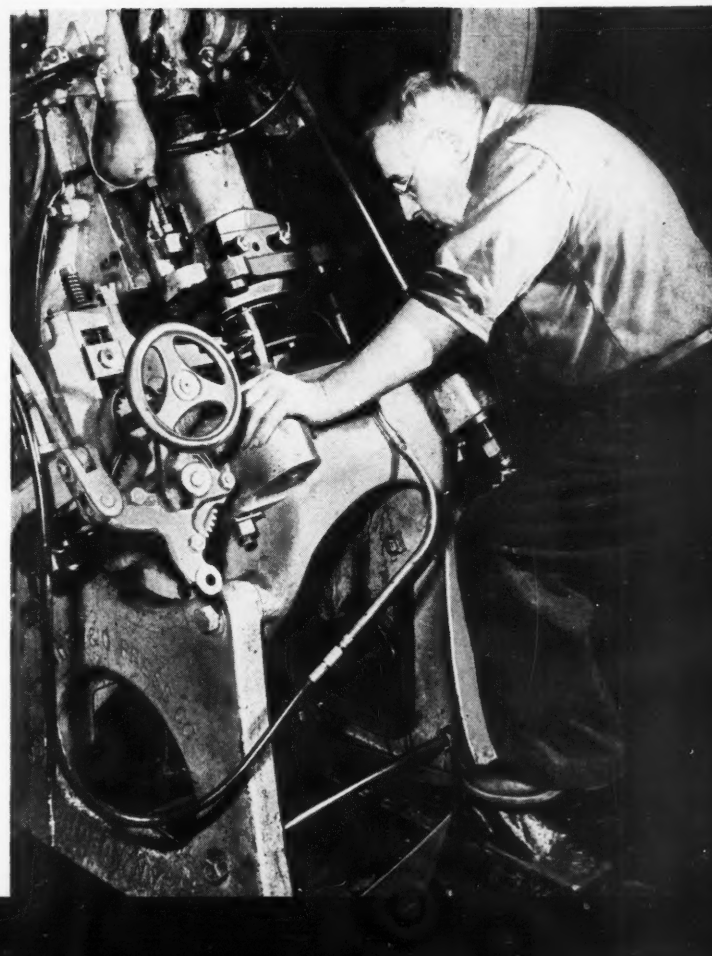

Fig. 11. Solid cold-rolled steel shims, 0.020 inch thick, are stamped at the rate of 3000 per hour, using coil stock, which is fed to a compound die in this set-up

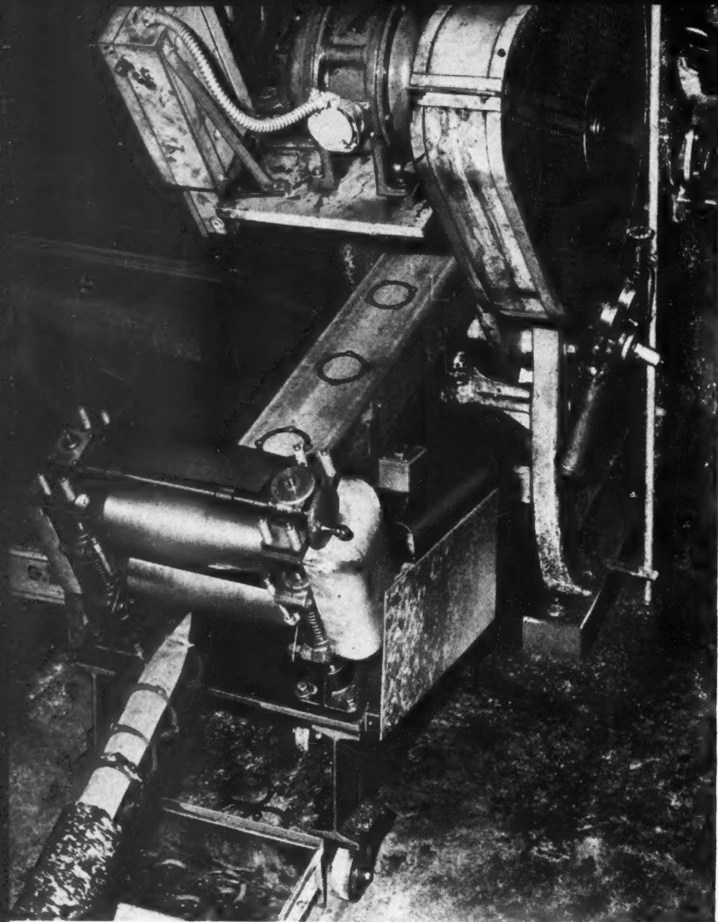

Fig. 12. Burrs are automatically removed from the shims produced in the set-up illustrated in Fig. 11 with the equipment shown. The shims drop on a conveyor as they leave the die and are carried between finely adjusted pressure rolls

of locating the work for subsequent operations. For round work, a rotary shear is employed to cut the shims to the proper outside diameter, tolerances for roundness being held within plus or minus 0.005 inch on a 24-inch diameter circle. Bolt or other holes that may be specified are then produced with standard tools, locating from the center hole and indexing the work as required (see Fig. 13). In the case of rectangular or square shims that may require radii at the corners, the stock tools previously mentioned would be used for forming the radii prior to piercing the bolt-holes.

As may be seen from the foregoing, the wide variety of shims made in this plant and the many different sizes produced (ranging from two or three pieces to several hundred thousands) require versatile production methods. An important application of shims at the present time is in ordnance and other military equipment that requires fast adjustments in the field.

* * *

Carboloy Initiates Technical Data Program for Defense Industries

A program, the aim of which is to furnish vital technical production data to defense industries, in order to enable maximum productivity with minimum tooling to be obtained in the manufacture of products for the armed services, has been initiated by the Carboloy Company, Inc., Detroit, Mich. The first step in the program has been the accumulation of all available data on the machining of shells and the arranging of this data in a complete kit for the use of manufacturers who either already have shell production contracts or who are bidding on such contracts.

The material included in the kit covers not only feeds and speeds, tool application and grinding, tool design, and brazing, but also tool layouts and methods of insuring maximum tool conservation. Supplementary data will be furnished to holders of registered kits as rapidly as information on new developments in shell machining practices and equipment becomes available.

On account of the importance of the information to the war effort, distribution of these kits is being closely controlled. No kits will be mailed on request. When a company has a shell contract, or when a company has been cleared by Army Ordnance to bid on shell contracts, a registered kit will be delivered to the company directly by Carboloy field engineers.

Data on machining of other defense products is also being compiled. In each case, consideration is being given to ways of reducing consumption of carbide tools to the minimum by insuring maximum effectiveness in use.

Fig. 13. Shims produced in small quantities are rotary sheared, after which a center hole is pierced. In this operation, bolt-holes are being pierced, with the shim located from the center hole and indexed as required

How to Produce More Holes with Your Drills

Fig. 7. About 400 drills are sharpened each eight-hour shift on this automatic drill sharpening machine. Lip relief angles on the ground point gradually increase from the periphery to the center of the drill

Advantages of Machine Grinding; Web-Thinning Procedure; Recommended Abrasive Wheels; and Inspection Methods — Second Installment of Two Articles

By R. J. SACK
Oliver Instrument Co.
Adrian, Mich.

ON specially designed drill sharpening machines, such as the Oliver "Drillpointer" shown in operation at the Mound Road plant of the Ford Motor Co. in Fig. 7, a drill point is automatically produced in which the lip relief angle gradually increases from the periphery to the center of the drill, thus producing the desired chisel-edge angle. About 400 drills of various sizes are sharpened every eight-hour shift on each of these machines. It has been estimated that machine-ground drills last from two to three times as long between sharpenings as hand-ground drills.

On these machines, both the lip relief angle and the point angle can be varied to suit the material to be drilled. Each sharpened drill is exactly like every other one, with the correct point angle, varying lip relief angle, and equal and uniform lip lengths and angles. Such machine-ground drills give maximum performance and improved accuracy, with a minimum amount of feeding pressure and power requirements. Tests have shown that when machine-ground drills were substituted for hand-ground drills, only 60 per cent of the feeding pressure and 75 per cent of the horsepower requirements were necessary. Also, in most cases, prior drilling of a smaller lead hole can be eliminated when machine-ground drills are employed. This is a considerable advantage, since lead holes are detrimental in most production drilling operations. When a lead hole is used, the chisel edge has no support and the drill has a tendency to chip on the cutting edges.

On the type of sharpening machine referred to, the drill is held in a universal chucking head by means of a two-jaw self-centering chuck, as seen in Fig. 8. Drills from 1/4 inch to 3 inches in diameter can be accommodated. Two- and four-flute drills are held directly in the chuck jaws, and three-flute drills are supported by split bushings. Shankless drills, such as those made by the Republic Drill & Tool Co., can be ground by holding the drill in a female center or in a special holder (such as the "Eject-or-Lock" driver manufactured by the J. C. Glenzer Co.). The driver of this type of drill can also be inserted in a solid drill socket for grinding the drill.

The chucking head, mounted on a universal carriage, can be swiveled to obtain any desired drill point angle from 82 to 160 degrees. The form of the drill point is controlled by a master cam, which can be adjusted to produce the lip relief angle or clearance best suited to the material being drilled. Once the cam is locked, it will reproduce a point of the same form until a change in adjustment is made. Chisel-point angles from 90 to 140 degrees can be developed.

The grinding wheel on the sharpening machine has two motions, an oscillating movement which carries the wheel across the cutting edge of the drill, and a movement that advances the wheel toward the drill as the drill revolves. By means

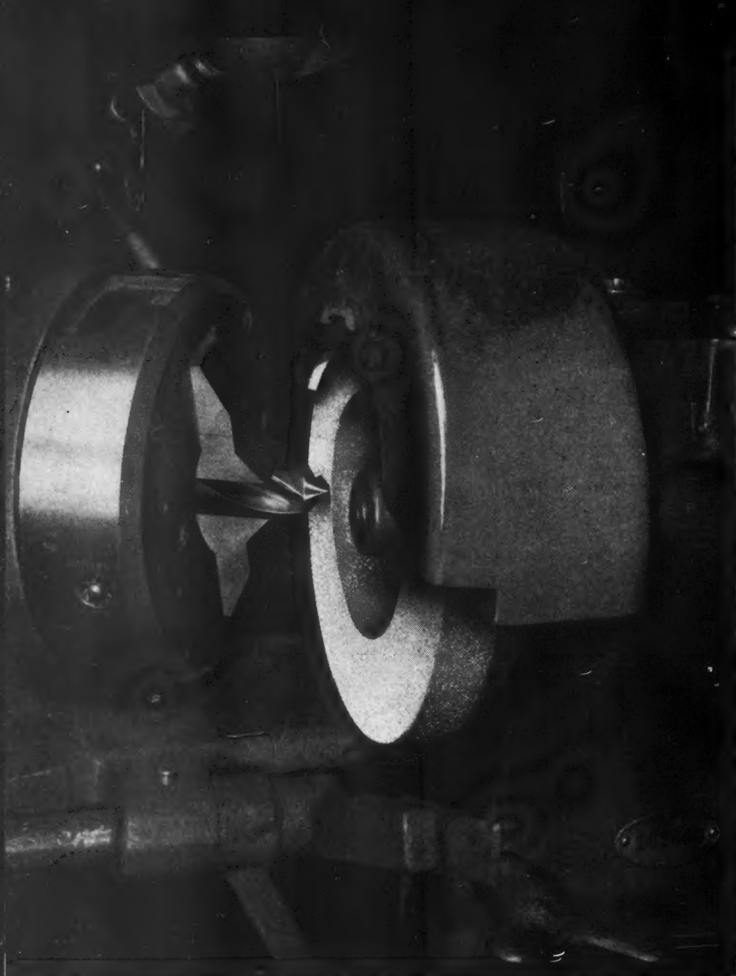

Fig. 8. Close-up view of the drill sharpening machine seen in Fig. 7, showing how the drill is held in a two-jaw, self-centering chuck. Drills from 1/4 inch to 3 inches in diameter can be ground on this machine

of these synchronized motions, produced by cam action, the lip relief angle is automatically increased from the periphery toward the center of the drill.

On the drill point produced with this machine, the amount of drop from the cutting edge to the heel remains the same for the full length of the cutting edge. Since both lips of the drill are ground simultaneously, only a minimum amount of stock need be removed in sharpening. In hand-grinding, more stock may be removed from one lip than the other, necessitating further grinding and waste of drill material.

Web-Thinning is Final Phase of Drill Pointing

The final important phase of correct drill sharpening, usually performed on a separate machine, is thinning of the web at the drill point, which restores the chisel edge to its normal length. As previously mentioned, the thickness of the web, or central portion of the drill body joining the lands, is usually increased or tapered toward the shank to provide greater strength. This increase is generally from 75 to 100 per cent of the web thickness at the point when the drill is new. Since the centrally located web or chisel edge does no cutting, it should be no thicker than necessary for strength. Web or point thinning therefore becomes necessary when the drill has been shortened by repeated sharpenings.

Point thinning, or decreasing of the web thickness, reduces the thrust or power required for the drill to penetrate the work. If the web is too thick at the drill point, power and pressure requirements will be excessive, more frictional heat will be generated, the drill will dull quickly, and splitting may occur. However, if the web is too thin, the drill may be weakened to the point of failure. In general, the web thickness at the drill point should be about one-eighth, and not less than one-tenth, of the diameter of the drill.

In point thinning, equal amounts should be ground from both flutes, taking care to insure that the web remains centrally located and that the existing dead center is maintained. The thinned portion of the web should not extend too far up the flutes, or the drill will be unduly weakened. Yet thinning must extend a sufficient distance so that an abrupt wedge will not be formed at the drill point. As a general rule, the thinned portion of the web should extend into the flute a distance approximately equal to, and not less than, one-quarter of the drill diameter, gradually blending into the unthinned portion of the web.

The shape of the thinned web should not prevent the chips that form on the cutting edges from flowing into the flutes. The grinding wheel used for web thinning should usually be slightly narrower than the width of the flutes, with the face rounded to conform with the approximate contour of the flutes. Although the width of the thinned web usually extends over only one-half to three-quarters of the length of the lip, it is sometimes extended out to the extreme edge in order to change the shape of the chip produced. In this way, an under-cut thinned point is obtained, and a fine, curled chip is produced.

The Oliver drill-point thinning machine seen in Fig. 9 consists primarily of a pedestal, a column that is adjustable vertically, and a carriage that supports the drill-holding mechanism and is provided with means for horizontal adjustment. The drill-holding mechanism consists of a drill rest and trunnion supporting casting which indexes the drill through an exact angle of 180 degrees. The grinding wheel motor is mounted on a movable carriage and a slotted swivel base. A rubber-bonded cut-off wheel, 1/8 inch thick, is used for most thinning operations. By setting the motor at an angle, the wheel can be drawn through the drill flutes at an angle, which produces the same results as if a wider wheel were used.

Different methods of thinning are illustrated in Fig. 10. That employed for the drill seen at

A is ideal in that the web is thinned and the cutting edges corrected (for being out of index) in one operation, without changing the hook on the cutting edges. The drill shown at *B* is thinned out ahead of the chisel point without grinding the cutting edge. This type point, however, cannot be used on all materials, and is generally recommended only for drilling soft metals.

Crankshaft Drills Require Special Point Thinning

So-called "crankshaft" drills, used in the deep-hole drilling of crankshafts and other parts, are manufactured with relatively thick webs. Such drills must be thinned at their points or provided with special points before they can be used. Generally, such drills are ground to an included point angle of from 118 to 136 degrees (128- and 135-degree point angles being common), a lip relief angle of 9 degrees, and a chisel-edge angle of 100 to 120 degrees.

In grinding the conical surfaces on the point of the drill, as seen at the left in Fig. 11, a chisel-edge angle of from 90 to 100 degrees is usually produced, the chisel edge being held straight and as close to right angles with the cutting edges or lips as possible. When the two notches are then ground to meet at the center of the drill, as seen at the right, the desired chisel-edge angle is formed.

The notching cuts form secondary lip relief or clearance angles, and are generally ground to an included angle of 70 degrees (forming angles of 35 degrees with the axis of the drill). All traces of the original chisel edge must be reduced to a point by grinding the notches up to the center of the drill. This forms two new and extra cutting edges along the former chisel edge, actually making a small-diameter drill out of the former chisel point.

Wheels Recommended for Drill Sharpening

Aluminum-oxide abrasive wheels having a vitrified bond of medium strength (Grade J to P) and structure (No. 5 grain spacing) are recommended for machine grinding of high-speed steel drills. The size of the abrasive particles may vary from 36 to 80 grain size, the coarser abrasive being used for larger size drills. The stronger grades of bond—M to P—are also used on the larger size drills. Such wheels provide a free cutting action, and are soft enough to remove stock without the danger of overheating or burning the cutting edges of the drill. The same type wheels can be used for off-hand grinding or web-thinning of high-speed steel drills.

A 70-grain rubber-bonded aluminum-oxide abrasive wheel, approximately 1/16 inch wide, can be used to cut off the points of badly worn or under-size drills. For sharpening carbide drills, a silicon-carbide abrasive wheel of finer grain (70 to 100) and medium grade (I to L), with a wider structure (8 to 12) and vitrified bond, is recommended. Diamond wheels, of 120 to 180 grain, may also be used for sharpening carbide drills when the production warrants the additional cost of such wheels. Frequent dressing of the silicon-carbide wheel is necessary in carbide drill grinding to prevent glazing. A roughly dressed wheel will cut carbide faster and cooler.

Wet Versus Dry Grinding

With a properly designed drill grinding machine, the use of a coolant is not necessary. Since light cuts are taken successively from alternate lips of the drill, the heat generated in grinding is not concentrated. Even though a slightly smoother surface finish can be obtained on the drill point with wet grinding, the increase in drill life is not appreciable, and such a finish is not essential for production drilling.

If a coolant is employed, however, an ample, continuous flow should be directed to the point

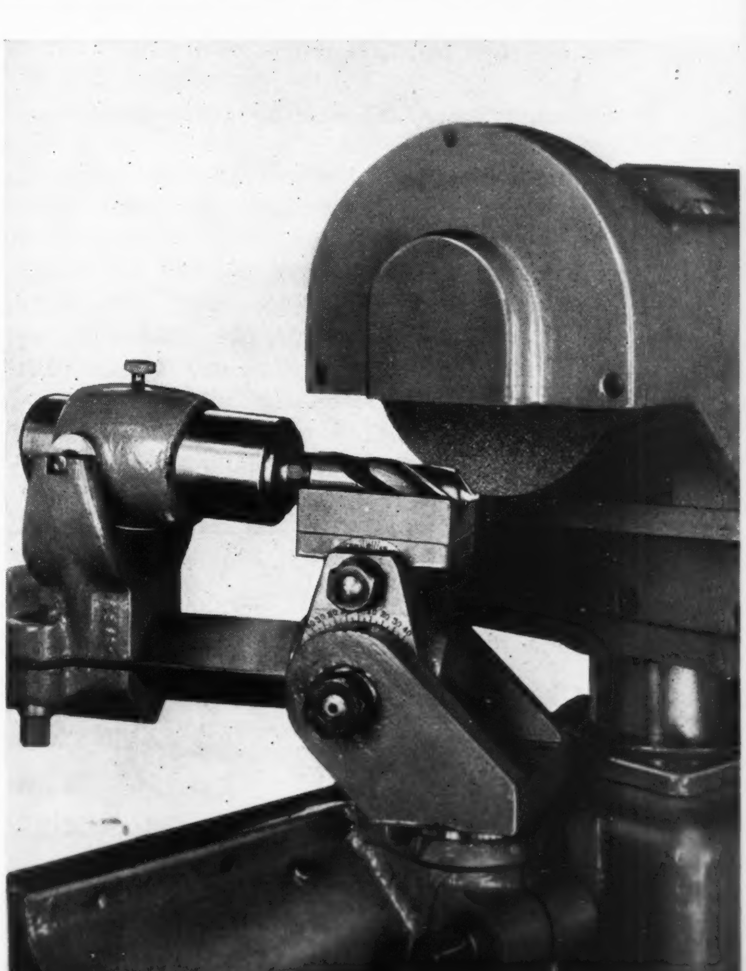

Fig. 9. Machine employed for thinning the web at the point of the drill. Equal amounts are ground from both flutes to keep the web centrally located

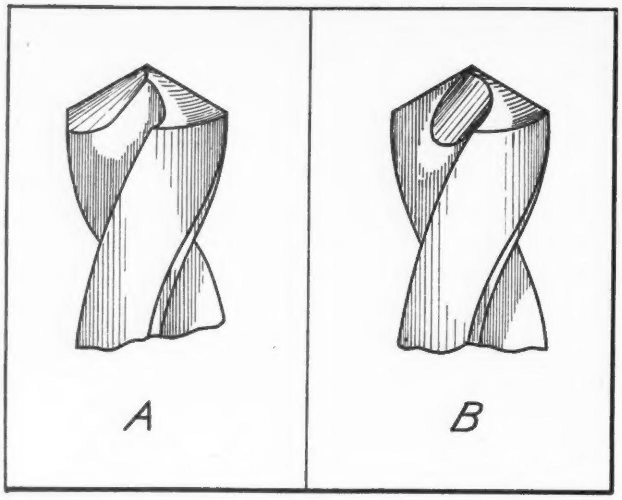

Fig. 10. Two recommended methods of web thinning, both of which can be accomplished on the machine illustrated in Fig. 9

of grinding to prevent the formation of surface cracks as a result of intermittent heating and cooling of the drill. Also, the soluble oil mixture generally employed should not be too rich. Mixtures as thin as 1 part of oil to 400 parts of water have been used successfully. Mixtures having a ratio less than 100 to 1 usually load the grinding wheel rapidly, and gum up the machine.

In off-hand grinding, if the drill becomes overheated, it should be allowed to cool in the air, and should never be immersed in water or other coolant. Such sudden cooling produces small cracks in the surface of the drill, which may result in chipping of the cutting lips or breaking of the drill point.

Inspection of Sharpened Drills Important

Centralization of the web at the drill point can be checked by laying the drill on a surface plate and measuring the distance from the plate to the lower end of the chisel point, which can be held vertically beside the scale, as seen at the left in Fig. 12. The drill can then be rotated through an angle of 180 degrees to observe whether both sides measure the same. In drills having an off-center web, one flute is shallower than the other. When this is the case, the shallow groove should be ground out either by hand or on a special drill-point thinning machine until both grooves measure the same depth at the point of the drill.

A drill can be tested for index by laying it on a surface plate and setting one lip (at the outer end of the cutting edge) a distance above the plate equal to one-half the drill diameter, as seen at the right in Fig. 12. With the drill held or clamped in this position, the distance of the other lip above the plate is measured to see if it is the same.

At the Ford Mound Road plant, sharpened drills are dipped into a hot plastic bath, which produces a coating approximately 1/32 inch thick. This inexpensive plastic coating dries immediately and protects the cutting edges during storage or shipment to the drilling machine. The protective coating can easily be peeled off when the drill is to be used.

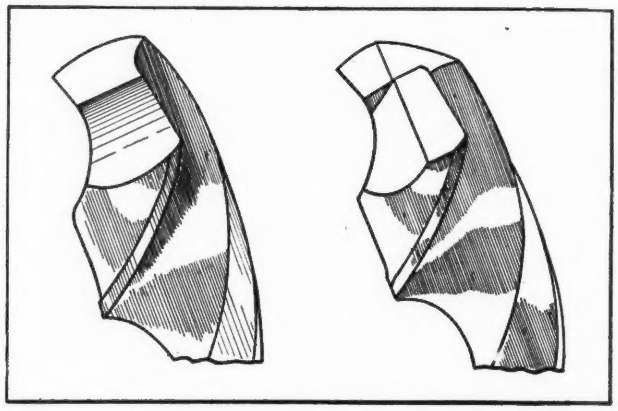

Fig. 11. A small-diameter drill—affording two extra cutting edges — is obtained from a chisel point by providing secondary lip relief angles

* * *

Last year, trucks hauled 5,300,000,000 tons of freight on our rural roads, and another 3,000,000,000 tons on strictly urban trips. That is a total of 8,300,000,000 tons of freight—or three times as much tonnage as was hauled by all our railroads, pipe lines, waterways and airways put together.

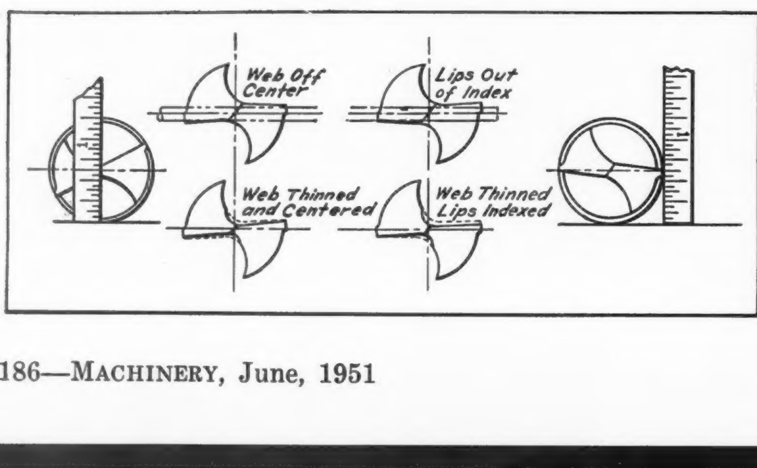

Fig. 12. Centralization of the web is inspected by measuring the distance of the chisel point from a surface plate, as seen at the left

High-Strength Pressure Vessel of Welded Stainless Steel

A WELDED-STEEL spherical pressure vessel for use by the U. S. Air Force in rocket-propelled aircraft experiments was recently completed by Research Welding & Engineering, South Gate, Calif. The vessel holds 200 gallons of liquid nitrogen under a pressure of 5500 pounds per square inch at a temperature of minus 340 degrees F. The "Nitro-Sphere," as it is called, was made from stainless-steel plate 3 11/16 inches thick. The completed sphere is 54 inches in diameter, and weighs approximately 7500 pounds.

The Allegheny Ludlum Steel Corporation supplied six stainless steel plates, each 38 inches square, rolling them as a special lot from 347 ASTM-A240 Grade C stock at its Coatesville, Pa., mill. The plates were pressed to shape, forming a 22 1/2-inch spherical radius after preheating to 1700 degrees F. They were then trimmed with flame cutting equipment, as seen in Fig. 1.

Fig. 1. Stainless-steel plates, 38 inches square by 3 11/16 inches thick, were heated and pressed to shape, and then trimmed and beveled in one operation by means of the flame-cutting set-up illustrated

Fig. 2. The "Dy-Chek" inspection method, which utilizes a dye surface penetrant, was employed following many of the welding passes to detect flaws. The spherical vessel is shown being inspected at an early welding stage

An interesting innovation in lay-out enabled the shaped plates to be both trimmed and beveled in the same operation.

Slag and residue formed during the trimming operation were removed by grinding. To insure against contamination, the parts also were pickled. The parts were then fitted and held temporarily in place with thin backing plates. The first weld passes were made by Heliarc welding. These welds were then subjected to inspection by both gamma ray and the Dy-Chek process—a method that utilizes a dye surface penetrant to detect flaws that might not be discernible by other means.

Following inspection of the first weld passes, the joints were filled by multiple-pass arc-welding. General Electric Type 1347 coated metallic electrodes, 3/16 inch in diameter, were used. In all, nearly a ton of weld rod was used on the job. The combined gamma ray and Dy-Chek inspection processes were repeated several times as the welds were built up.

Finally, the work was heat-treated to achieve an annealed condition. The sphere was heated at 1950 degrees F. for 3 1/2 hours, and then subjected to both internal and external quenching through the use of high-pressure jets. It was then given a hydrostatic test at 10,000 pounds per square inch pressure. Finally the "Nitro-Sphere" was again inspected by the methods previously mentioned.

* * *

The United States with only one-sixteenth of the world's people, produces about two-fifths of the world's goods.

Materials OF INDUSTRY

The Properties and New Applications of Materials Used in the Mechanical Industries

Stainless Steel that Responds to Low-Temperature Hardening

A new grade of stainless steel, developed by Armco Steel Corporation, Middletown, Ohio, has high hardness and strength, excellent corrosion resistance, and good fabrication characteristics, although it requires only a low-temperature, double heat-treatment. This alloy, called "Armco 17-7 PH" stainless steel, is recommended for deep-drawing and severe forming operations, and is said to offer new fabricating properties beyond those of high-strength Type 301 stainless steel. It is available in the form of sheets, strips, plates, angles, bars, forging billets, and wire. Sheets and strips are produced in soft and hard tempers; plates in soft temper only. Typical mechanical properties of soft temper sheets, strips, and plates are given in the table below.......42

Properties of Armco 17-7 PH Stainless Steel

Properties	As Supplied (Annealed)	Fabricator Treated (1400 Degrees F. plus 950 Degrees F.)
Ultimate tensile strength, pounds per square inch....	115,000 to 150,000	185,000 to 210,000
Yield strength in tension, pounds per square inch (0.2 per cent offset).......	35,000 to 55,000	150,000 to 190,000
Yield strength in compression, pounds per square inch (0.2 per cent offset)..	......	160,000 to 200,000
Elongation in 2 inches, per cent	20 to 40	7 to 12
Hardness, Rockwell	78 to 92 B	40 to 45 C
Modulus of elasticity........	29,000,000	29,000,000

Chromium-Plating Anode of Open Type Construction

Hanson-Van Winkle-Munning Co., Matawan, N. J., has developed a new type of chromium-plating anode, called "Chrome-Flo," for which the following advantages are claimed:

Insoluble chromate film formation on anodes is markedly decreased; its open type of construction makes higher current densities possible due to better circulation of solution and increased anode surface exposure; decreased weight of anodes facilitates easier handling; and increased covering power due to wider current density range.

Anodes of this new construction are available in the 6 per cent antimony-lead, 7 per cent tin-lead, or any other commonly used alloy.......43

Chemical for Bonding Silicone Rubber to Metal Surfaces

Silicone rubber can be bonded to metals or ceramics by a new chemical, designated G-E 81267 primer, recently announced by the General Electric Co., Pittsfield, Mass. The material is said to have the ability to develop a bond strength greater than that of rubber. The shear strength of bonds on steel is approximately 700 pounds per square inch.

To mold and bond G-E silicone rubbers to a surface, it is necessary first to remove all grease and dirt from the surface. The primer is then applied by dipping and draining, spraying, or brushing. The film is allowed to dry in the air for twenty minutes, after which the surface is rinsed with water and dried.

The primed surface can be molded under pressure at a temperature of 125 degrees C. against freshened high-strength silicone rubber for from ten to twenty minutes; using 40 pounds per square inch steam in molding, the time required is twenty to twenty-five minutes. Possible applications include shock and engine mounts that resist both high and low temperatures and rubber-glass laminated structures. 44

To obtain additional information about materials described here, use Inquiry Card on page 229.

TOOL ENGINEERING *Ideas*

Tools and Fixtures of Unusual Design and Time- and Labor-Saving Methods that Have been Found Useful by Men Engaged in Tool Design and Shop Work

Gage for Measuring Conical Recess

By W. M. HALLIDAY, Birkdale, Southport, England

A special telescoping gage designed to facilitate checking the mean diameter of a conical recess machined in a cast-iron part is shown in Fig. 1. Although specifically designed for use in measuring the diameter Y of the conical recess in the piece W, the gage can also be adapted for other checking operations, such as measuring dovetail grooves. The difficulty or impossibility of accurately measuring the diameter of the conical recess with instruments ordinarily available led to the development of the telescoping gage. Internal micrometers and gage-blocks, for example, could not be inserted or properly located through the bored hole above the conical recess, a difficulty which was overcome by the telescoping feature of the special gage.

In Fig. 1 the telescoping gage is shown in the correct position for measuring the mean diameter Y of the conical recess in piece W. When in this position, the half-spherical buttons E and K make contact on diametrically opposite sides of the conical recess, or cavity, at points T and U. The lugs D and I are finished to the accurately calculated length Z, which equals $S + O$, where S is one-half the height of the conical recess and O equals the offset required to bring buttons E and K into contact with diametrically opposite sides of the conical recess on the mean diameter line. The amount of offset O (see Fig. 2) equals the radius R of the contact button multiplied by the sine of the angle of inclination θ of the side of the recess.

The arms B and G, Fig. 1, are so machined that the dimension X, measured over the faces C and H, is exactly one-half the dimension V, measured over the ends of contact buttons E and K, when the gage is collapsed or adjusted so that V is equal to the dimension Y to be gaged. In this example, the actual mean diameter Y to be checked is 8 inches. Therefore, when the gage is set so that V is 8 inches, the corresponding measurement X over faces C and H is 4 inches.

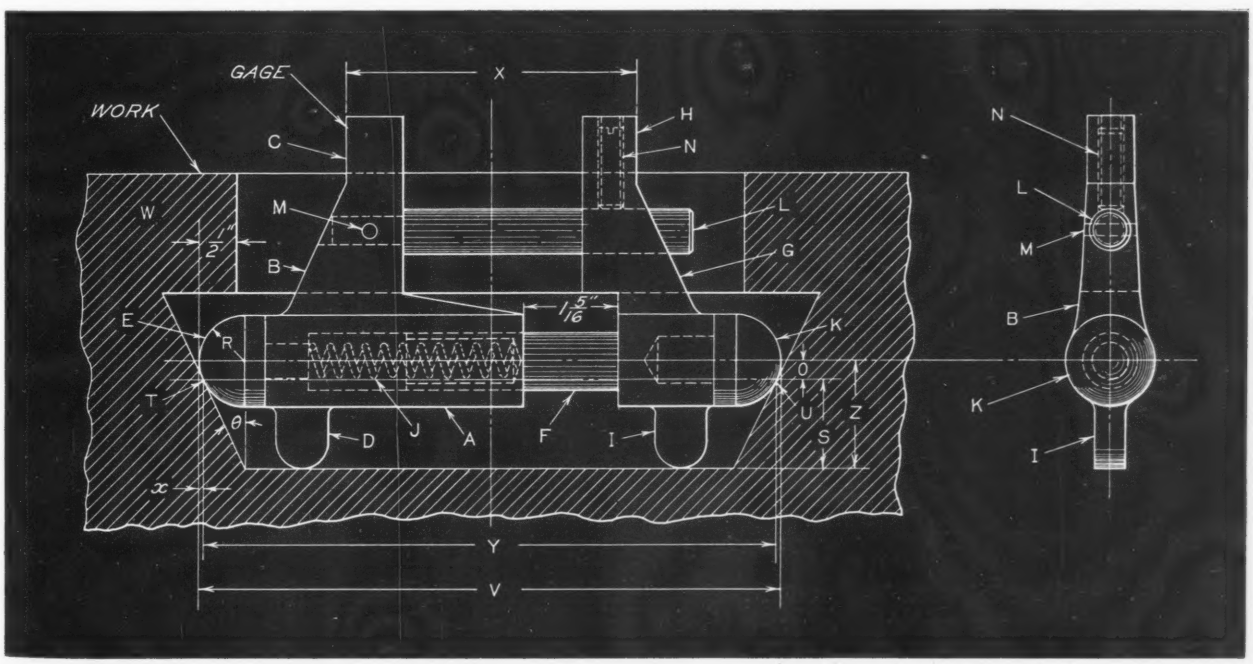

Fig. 1. Gage of special design developed to permit accurate measuring of conical-shaped recess by means of an outside micrometer

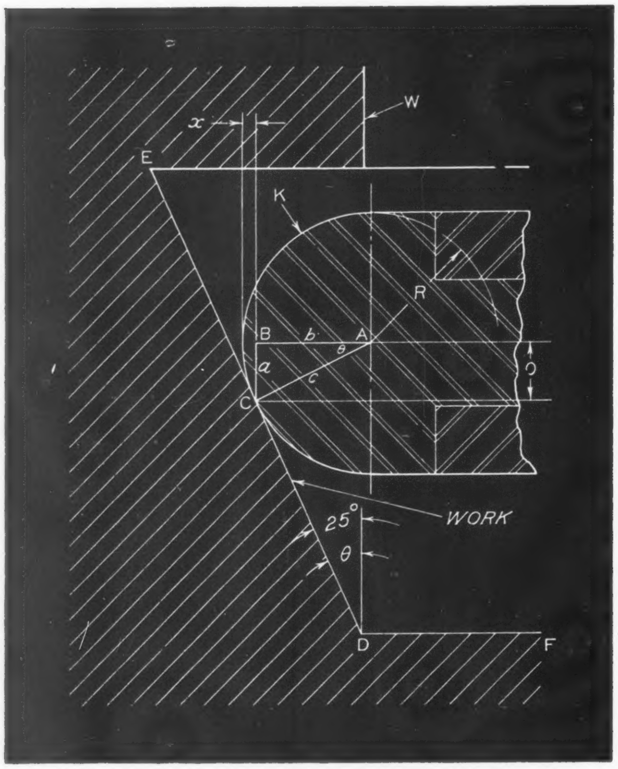

Fig. 2. Diagram illustrating method of making calculations required in designing, constructing, and using gage shown in Fig. 1

However, when the gage is used to check dimension Y (which is 8 inches) the actual micrometer reading will be 4 inches plus $2x$. When thus set, the gage has a collapsing range of 1 5/16 inches, which allows a clearance of 5/32 inch between each button and the bore of the large hole above the conical recess. This is sufficient to permit insertion or removal of the gage when it is fully collapsed. Making the gage with dimension X equal to one-half Y, as described, facilitates accurate checking of the gage itself and simplifies the calculation of measurements required in designing, constructing, and using the gage.

The diagram Fig. 2 shows an enlarged cross-section of the half-spherical contact button K in the measuring or checking position—in contact with the side of the recess in the work. Referring to this diagram, the calculations required in designing and using the telescoping gage can be made by using the following formulas:

$$O = R \times \text{sine } \theta,$$

in which

O = amount center of contact buttons E and K are offset above mean diameter line to be measured in order to have buttons make contact with sides of conical recess on the mean diameter line;

R = radius of the spherical contact buttons E and K;

θ = angle of inclination of the side of conical recess.

The amount x, which must be doubled and added to 4 to obtain the correct micrometer measurement X, Fig. 1, in inches, for a correct measurement of 8 inches for Y, is found by the formula

$$x = R - (R \times \cos \theta)$$

The telescoping feature, which permits the gage to be collapsed for insertion in the cavity, then expanded for measuring, and finally collapsed for removal, is obtained by having the shank F, Fig. 1, a close sliding fit in a lapped hole in the body A. The guide rod L, secured in arm B, is a close sliding fit in a lapped hole in sliding arm G, and serves to keep the sliding member with locating button K in accurate axial alignment with button E and measuring face H in accurate alignment with measuring face C. A brass retaining screw N is provided to permit locking the sliding arm in any position desired.

In applying the gage, screw N is first loosened and shank F of sliding arm G pressed into the bore of body A and arm G brought in contact with arm B, compressing the light spring J. Screw N is then tightened to hold the gage members in the collapsed position. When thus collapsed, the gage is lowered into the recess until lugs D and I rest on the bottom of the conical recess. With the gage in this position retaining screw N is loosened. Spring J will cause the sliding shank F to move outward until button K makes contact with the side of the recess. By carefully moving one end of the gage slightly to and fro in a lateral radial direction, the gage can be easily set to the maximum measuring diameter on the mean diameter of the conical recess. In this position, the gage should be set by the retaining screw N. Having thus set the gage, a micrometer reading is taken over faces C and H to obtain measurement X for comparison with a predetermined measurement for this dimension, which is either calculated or obtained by the cut-and-try method from a sample component to correspond with the correct mean diameter Y of the recess. After the measurement X is taken, the retaining screw N is loosened, the gage collapsed, and the screw N tightened. The gage can then be removed, ready to measure another piece.

All the critical working elements and measuring contact points or buttons of the gage must, of course, be hardened and accurately fitted. The gage can be used to measure annular grooves and slots of various kinds which are in inaccessible positions.

Fixture for Controlled-Depth Milling of Gasket Slots

By ROBERT W. NEWTON, Tool Engineer
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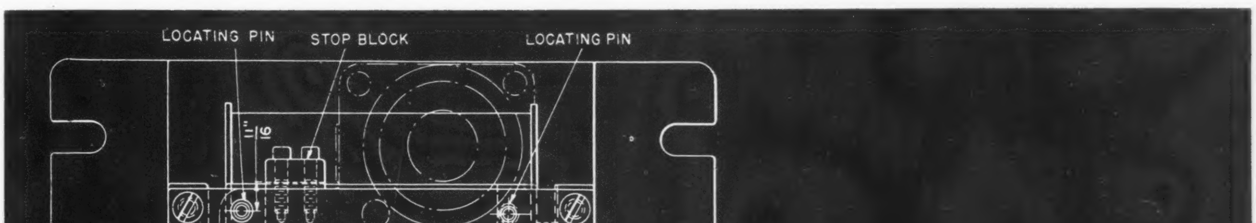
Poughkeepsie, N. Y.

In machining certain parts, it is sometimes necessary to control the depth of milling closely. In such cases, it is generally desirable to locate the top face of the part against a positive stop on the fixture. To do this and still have a rigid fixture that is economical to build and easy to operate often presents a difficult problem for the designer. The work-piece shown by dot-and-dash lines in the accompanying illustration is a body casting for an air-brake valve. The depth of the gasket slot in this piece must be held to within ± 0.003 inch. A fixture designed to hold this part while milling the gasket slot is described in the following.

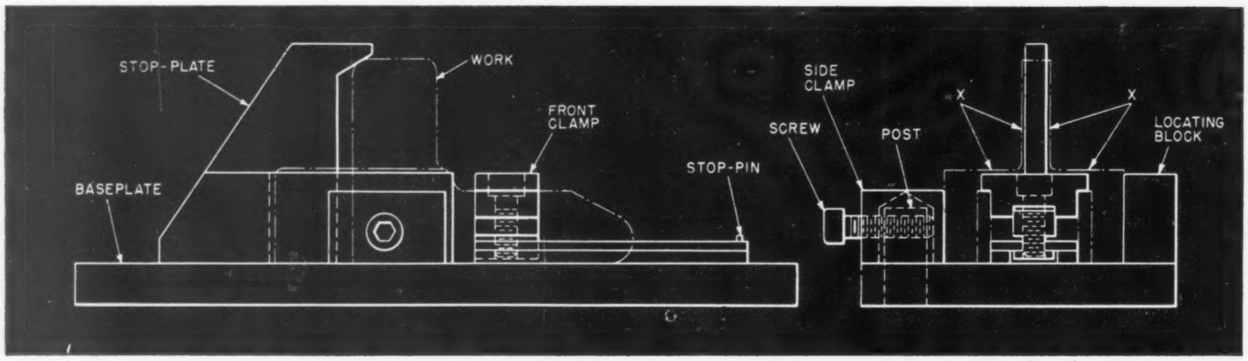
The cast body of the fixture consists of an extra-heavy center section, two upright legs, and a wide bolting flange at each end. The top surfaces of the legs are finished, and a bar is fastened across each end of the legs by means of socket-head cap-screws. The top face of the work is clamped against the under side of these bars. Two locating pins, which enter bolt holes previously drilled in the work, are driven into the lower face of one of these bars.

To aid in loading the work on the locating pins, two stop-pins are driven into the inner face on one of the upright legs of the fixture body. On the opposite side of the bar containing the locating pins is fastened a block that serves as a stop for the work in the other direction. To facilitate loading the work, the ends of the locating pins are provided with 3/32-inch by 45-degree chamfers. Since these chamfers are 1/32 inch greater than the 1/16-inch clearance allowed from the center of the locating pins to the edge of the stops, the locating pins will partially enter the bolt holes in the work-piece when it is against the stops.

An inclined slot, approximately the same width as the work, is machined into the heavy center section of the fixture body. A wedge-block clamp slides on this inclined plane. Across the lower end of the inclined slot is fastened a plate, into which is threaded a large square-head set-screw. A slot in the wedge-block provides a slip fit for the end of this screw. A larger slot



Gasket slot depth in the cast air-brake valve body (shown by dot-and-dash lines) is maintained within ± 0.003 inch by means of this milling fixture



Simple and inexpensive fixture which features unusual arrangements for clamping a forging during a duplex milling operation

behind this one provides clearance for a swivel that is held on the end of the set-screw by means of a pin driven through the swivel and sliding in a groove machined in the end of the set-screw. The locating pins are made as short as is practical, so that the wedge-block will only have to move a minimum distance in order to clamp the work.

Care must be taken in making the pattern for the fixture-body casting so that the inside fillets on the body, where the upright legs meet the heavy center section, are small enough to allow the work to be loaded. Otherwise, the metal will have to be machined out to provide the necessary clearance. To increase the strength of the fixture-body casting, large fillets are provided where the bolting flanges meet the heavy center section.

Keys fastened to the under side of each bolting flange serve to locate the fixture on the milling machine table. Since the work-piece is heavy, four slots are provided in the fixture to fasten it to the table with an adequate degree of rigidity.

After the fixture is located on the milling machine table and fastened in place, it is ready for use. With the wedge-block down flush with the top of the center section of the fixture body, a work-piece is slid onto the wedge-block until it is against the stop-pins and the stop-block. Then the set-screw is turned with a wrench. As the wedge-block rises, the chamfer on the locating pins will force the work-piece into position until the locating pins are in the bolt holes. After the work has been clamped tightly, it is milled.

To remove the work from the fixture after it is milled, the set-screw is loosened. When the wedge-block has been lowered until it is flush with the top of the center section of the fixture body, the work will have dropped off the locating pins. Then the milled valve casting can easily be removed from the fixture.

Duplex Milling Fixture with Unusual Clamping Means

By R. MERY
Liberty Products Corporation, Farmingdale, L. I., N. Y.

The simple, inexpensive fixture seen in the illustration has rather unusual arrangements for clamping a forging while milling the four surfaces X in a duplex milling operation. The work rests on the baseplate of the fixture and is pressed firmly against the stop-plate and locating block. Then by tightening the screw-operated front and side clamps, the part is ready to be milled.

An angular surface at the top of the stop-plate exerts a downward force on the forging to prevent it from vibrating during milling. The side clamp is drilled to provide ample clearance for a vertical post to be pressed into the baseplate, and for a screw threaded into this post. When the screw is tightened, the side clamp forces the work against the locating block.

The front clamp is an assembly of two blocks and a screw. The lower block fits into a T-slot formed by two narrow and two wide strips that are secured to the baseplate. After the milling operation has been completed, the screws in the front and side clamps are loosened and the front clamp is moved back until it contacts a stop-pin. The milled part can then be lifted from the fixture and a new forging put in place.

Work-Holding Fixtures for Special Lathe Operations

By D. M. BRANDEL, Alton, Ill.

For lathe operations where conventional work-holding means cannot be employed, special fixtures such as shown in Fig. 2 may be found useful. Generally, fixtures of this kind, after having been removed from the lathe, must be re-

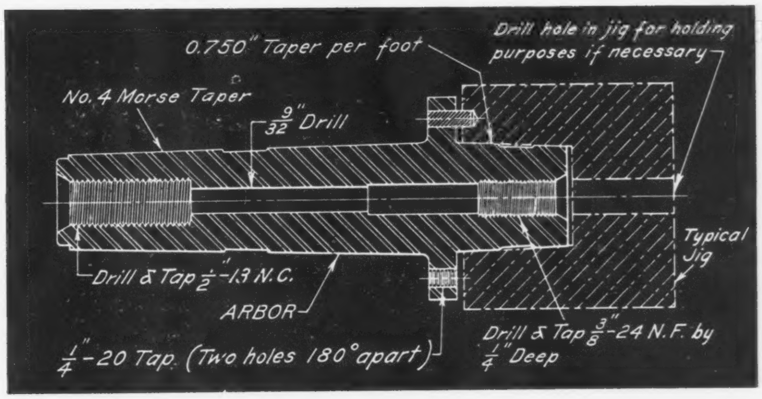


Fig. 1. Arbor for holding special fixtures in lathes. With this arbor, a fixture can be removed from a lathe and replaced so that it will run concentrically without being checked

chucked and checked for concentricity when they are replaced. This is a time-consuming operation, subject to inaccuracies, and the fixtures may be distorted from the chucking.

These disadvantages are eliminated by using an arbor such as the one illustrated in Fig. 1 to support the fixtures. With this arbor, when it is desired to replace a fixture in the lathe, it is merely reassembled on the arbor, which is provided with a holding taper to match one in the fixture. The assembly can then be inserted in the lathe headstock with the assurance that it will run concentrically.

A No. 4 Morse taper shank is shown on the arbor in Fig. 1, but this, of course, may be made to suit any lathe or other machine being used. The fixtures can be made without special tools. For example, a 1-inch standard pipe reamer is employed for finishing the tapered hole (3/4 inch taper per foot), because this reamer is easily obtained from supply houses and is much cheaper than those made especially for the job. The taper obtained provides the self-holding properties required. A pin in the flange of the arbor supplies the driving force for the jig and prevents slipping.

In addition to the holding taper, other methods may be employed for holding the fixture on the arbor. For example, a socket-head capscrew can be inserted in the Morse taper end of the arbor so that the bottom of the head of the screw rests against the shoulder at the end of the 1/2-13 tapped hole in the arbor. With the fixture tapped to suit, the screw can be used as a draw-bolt. Another method is to insert a screw through the hole in the fixture to engage the 3/8-24 tapped hole in the arbor.

It will be noted that the tapped hole in the Morse taper end of the arbor can be used for engagement with a draw-bar to secure the arbor in the lathe. Tapped holes are provided in the flange for jack-screws that may be employed to remove the fixture from the arbor. With ingenuity, many different fixtures and arbor arrangements can be devised and applied to speed up short-run production and to facilitate special lathe operations.

* * *

The Jacobs Mfg. Co., of West Hartford, Conn., was recently presented with the Accident Prevention Flag by the Liberty Mutual Insurance Co. for its outstanding industrial safety record in the three-year period since January 1, 1948. During this time, the West Hartford plant maintained a lost-time accident frequency 38 per cent better than the national average.

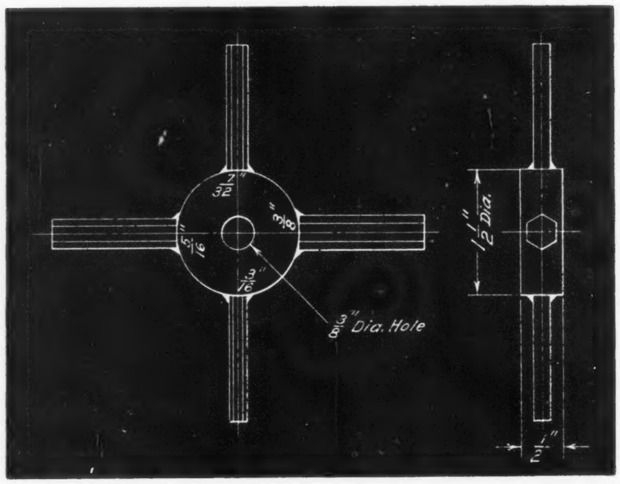
Fig. 2. Special fixtures used with arbor shown in Fig. 1 for holding work in lathes when ordinary means cannot be employed. The view in the center shows a fixture mounted on the arbor. At the lower left is shown a standard pipe reamer employed in making the fixtures

Ideas for Shop and Drafting-Room

Device that Keeps Wrenches at Hand for Convenient Use

By IRVING MANSFIELD

The gadget illustrated was devised to prevent fumbling around in bench drawers or tool-boxes for the right size wrench for hexagon-socket cap-screws. Four different size wrenches are cut off and welded to a round piece of cold-rolled steel. Although just about any size wrenches can be used, the 3/16-, 7/32-, 5/16-, and 3/8-inch sizes are the best because they are employed on the most popular sizes of screws in use today. A hole may be drilled through the center of the device, so that it can be hung up.



Hexagon-socket cap-screw wrenches are kept at hand for convenient use by welding them to a round piece of steel

Handy Safety Device for Mounting Heavy Lathe Chucks

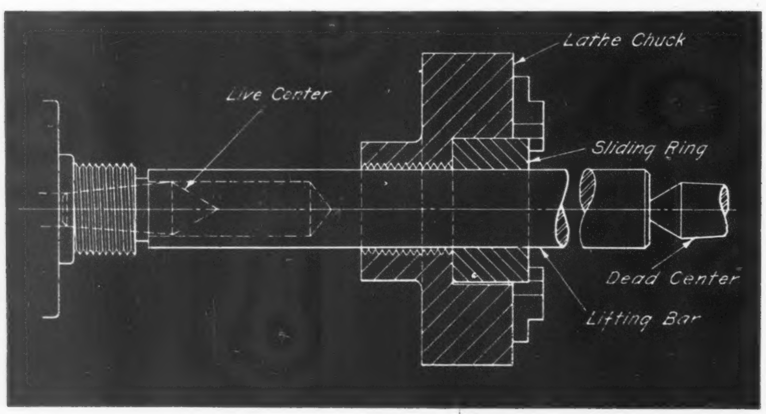
By JAMES J. BAULE, Brooklyn, N. Y.

Large lathe chucks that are cumbersome, hazardous, and too heavy for an operator to handle alone can be mounted by means of the handy device shown in the accompanying illustration. The device consists of a lifting bar and sliding ring, with the bar drilled at one end to fit over the live center on the lathe and at the opposite end to accommodate the dead center. The ring is bored to provide a free sliding fit on the lifting bar, and its periphery is turned to fit the bore of the chuck. Clearance, of course, must be provided between the threaded bore of the chuck and the periphery of the lifting bar.

When the chuck is not being used, it is stored in back of the lathe on a specially made bench—the top of the bench being the same height as the ways of the lathe. When it is to be used, the chuck is rolled onto the ways, near the lathe headstock, and the drilled end of the bar is pushed through the chuck and on the live center. Then the ring is slid over the bar and into the chuck bore, and the unsupported end of the bar is lifted and placed on the tailstock dead center. The chuck and ring are next pushed into position and the chuck secured, after which the bar and ring are removed.

* * *

At the start of the Twentieth Century, the nation's steel capacity stood at a little over 24,000,000 net tons annually. By the end of the first decade of the century, it had grown to approximately 39,000,000 tons. In the next twenty-five years, it doubled to over 78,000,000 tons. By 1940, steel capacity had been increased to 81,619,000 tons, and in 1950, the figure was 100,500,000 tons at mid-year.



Lifting bar and sliding ring, suspended between live and dead centers, facilitate the mounting of large, heavy chucks on a lathe

How to Drill Cast Iron with Carbide Twist Drills

LABORATORY tests, supported by production applications, have now reached the point, according to Carboloy Company, Inc., where specific recommendations can be made regarding the drilling of cast iron with carbide-tipped twist drills. Such drills may be used at either conventional or considerably higher drill speeds, while results as to life per grind are comparable with those obtained with carbide tools on other kinds of operations. A typical carbide-tipped twist drill, such as was used in tests and production applications, is shown in Fig. 1. The drill is made simply by inserting a standard Grade 44A carbide twist drill tip, upper right, in the end of a conventional high-speed steel twist drill.

With this type of drill, uniform results are now being obtained, using the same drilling equipment as was formerly employed with high-speed steel drills. The precautions to be taken, as far as machine and fixture conditions are concerned, do not differ from good practice for high-speed steel drilling. The prime requirement in this respect, when it is desired to take advantage of the increased drilling speeds and feeds made possible by carbides, is that the drilling equipment have enough power to take care of the increased rate of chip removal.

Excellent results have been obtained by a leading twist drill manufacturer in brazing carbide tips to the end of regular high-speed steel twist drill bodies as one of the regular manufacturing operations. The conventional 118-degree point angle is ground on the end of the drill at a 12-degree lip relief angle, as shown in Fig. 2, by using a 180-grit, resinoid-bonded, diamond cup wheel. It is advisable to first remove both the excess steel and carbide with a silicon carbide wheel by grinding a 14-degree clearance angle up to a 1/32-inch wide land, as shown in Fig. 2. The longest drill life is obtained when the cutting edges along the drill lip are smooth, keen, and without blemishes. The drill-lip lengths should be identical, and to facilitate a free flow of chips, the drill flutes should be polished.

Such drills have been produced both by carbide tool manufacturers and by tool users who have the necessary simple brazing and grinding facilities. In the latter case, the users have been purchasing conventional high-speed steel drills and then tipping them with carbide before putting them into service. An 8-degree right-hand spiral at the drill lip, increased to a 15-degree right-hand spiral for the flutes through the drill body, gives a free movement of chips out of the hole.

So far as equipment is concerned, the same machines as are used for high-speed steel drills can be employed, and speed or feed rates can be stepped up so that increased output is obtained in addition to longer tool life. It is not good practice, however, to increase speeds or feeds if this overloads the motor to the extent that it slows down the spindle during the cut. Clutches should also be checked when carbide drills are used in this manner. If an increase in motor load produces a tendency for the clutch to slip, the drill life obviously would be affected.

Radial drill presses are well suited to the use of carbide twist drills for drilling cast iron. As when drilling with high-speed steel drills, the usual precautions are employed, such as keeping spindle end play to a minimum and checking the alignment of drill jig bushings with an indicator if such bushings are used.

With regard to drill-holders, the best practice is to fit the drill directly into the spindle socket or into reducing sleeves. Quick-change holders may be employed, but floating holders are not recommended. The spindle-nose sockets, reducing sleeves, and drill shanks should be kept free from burrs to maintain drill alignment with the

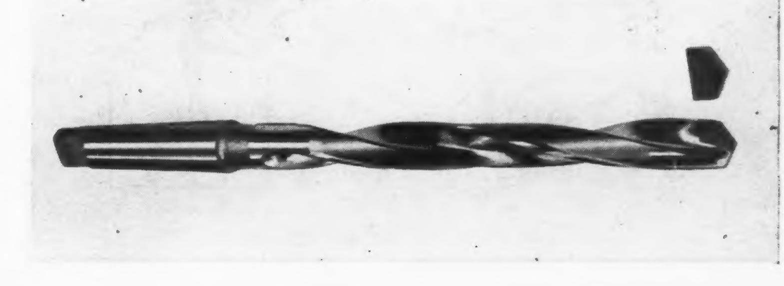


Fig. 1. Carbide drill made by inserting Carboloy Grade 44A carbide tip in the end of a conventional twist drill

guide bushings and to keep the drill running true. However, this is no different from good practice with high-speed steel drills.

In drilling cast iron with carbide twist drills on conventional equipment, practically any speed in the range of 75 to 200 surface feet per minute gives good results. There is no more necessity for reducing feeds when higher speeds are used with carbide drills than there is when steel drills are employed. Therefore, the selection of a drilling speed (within the range of the equipment) simply becomes one of balancing the increase in output against the increase in drill life.

In general, if the equipment permits, a simple means of starting a cast iron drilling job with carbide drills is to use a speed about twice that normally employed with high-speed steel drills and the same feed per revolution as with steel drills. There are indications of some relationship between the depth of holes being drilled and the drill speed used with twist drills having brazed-in carbide tips. Speeds as high as 200 surface feet per minute with 0.013 inch feed per revolution have been used while drilling 13/16-inch diameter holes up to 5 1/2 inches deep from the solid without any sign of breakdown of the braze due to the increased temperature developed by the longer drilling period and the greater accumulation of hot chips. For drilling holes much deeper than this, it might be advisable to use somewhat lower cutting speeds (not lower than for high-speed steel drills) when starting a job, at least until experience has demonstrated that higher speeds will not affect the braze as a result of the increase in operating drill temperature.

Drill feeds between 0.008 and 0.013 inch per revolution have given good operating conditions on quite a variety of jobs. Lighter feeds are not usually advisable. They seem to contribute, at times, to an erratic cutting action evidenced by objectionable vibration or "sing." Such vibrations seem to result in breakdowns.

When carbide twist drills vibrate or "sing," the best practice is to increase the feed per revolution. In general, this will not only give quieter operation, but will also increase the number of holes per grind of the drill. The number of times the drill can be ground will also be increased, since little material has to be removed in sharpening a carbide twist drill that has been operating properly.

In general, it might be said that it is better practice to increase the output with carbide twist drills by first increasing the feed rather than the speed—particularly if the equipment, operating conditions, or material being drilled does not permit increasing both speed and feed. As a matter of fact, when drilling the harder cast irons, the output can be increased more effectively, with maximum tool life, by using the same speeds as for high-speed steel drills but increasing the feed per revolution.

It is always good practice to start drilling holes from machined surfaces. This aids in maintaining the accuracy of hole locations, as with steel drills, and contributes to longer drill life as well. When carbide twist drills are used in set-ups not employing bushings in drill jigs, it is advisable to spot-drill. This, of course, is also good practice when using high-speed steel drills.

The conventional practice of employing a center-punch followed by spot-drilling is satisfactory for carbide drills too. If desired, the spot drill may be carbide tipped, so that the operator will not have to change spindle speeds on the machine. Carbide spot drills should be as short as possible to insure that the holes will be located in a manner that will give minimum run-out. When this general practice is followed, the quick-change tool-holders usually employed for holding both the spot drill and the twist drill in the same collet are satisfactory for carbide drills.

Whenever possible, it is desirable to drill holes in cast-iron parts from the solid instead of using the drill to enlarge a cored opening in the casting. Frequently the shifting of cores during the casting operation in the foundry results in an uneven stock removal. This, in turn, causes a

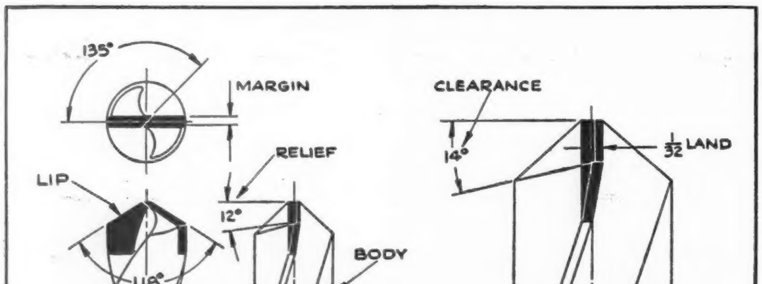


Fig. 2. Conventional point and lip angles ground in carbide-tipped twist drills

decided drill run-out, which, combined with the fact that the drill lips near the drill margin are working in rough, scaly, and sandy work surfaces, may result in chipping of the tool and excessive wear. This, of course, shortens the drill life of either carbide or high-speed steel drills.

When setting up a new job for carbide drilling, it is advisable to record the number of holes drilled for a given set of speed-feed conditions for several runs to obtain the average holes per grind. Two or three trial runs may be necessary to determine the most effective speed range. At no time should the drills be allowed to become excessively dull, thereby causing complete drill failure.

This data can then be used not only to determine the best operating conditions, but also to indicate the number of holes after which a drill should be removed for sharpening. Usually the best procedure is to set the time for changing the drill at 50 to 100 holes less than the minimum obtained in the trial runs. As with other carbide tools, carbide twist drills should be removed for sharpening before they become really dull, if maximum production and maximum overall drill life are to be obtained. The consistency with which carbide drills operate when correctly applied makes this practice entirely feasible. For instance, on a tough job where drills had chipped after runs of 750 holes per grind, no difficulty was experienced when the drills were changed after each 700 holes.

Almost all drilling of cast-iron parts to date has been done dry, since this practice holds the range of temperature fluctuation to a minimum, thus contributing to longer drill life. In cases where a coolant must be used, a soluble oil solution is satisfactory. However, the shock resulting from the coolant hitting the hot carbide as it is pulled out of a hole where it was covered with hot chips may reduce the number of holes per grind, as well as shorten the drill life. Under such conditions, operating the drill in the lower portion of the carbide drill speed range will reduce the cutting temperature and improve drill life.

An automatic valve arrangement, whereby the coolant is shut off just before the drill is pulled out of the hole and turned on again just before the drill starts to operate, will also prove helpful. A typical operation to which this applies is on machines where coolant is necessary because other machining operations are performed at the same time.

Such materials as ordinary cast brass and bronze can also be drilled with carbide-tipped twist drills at the higher cutting speeds and

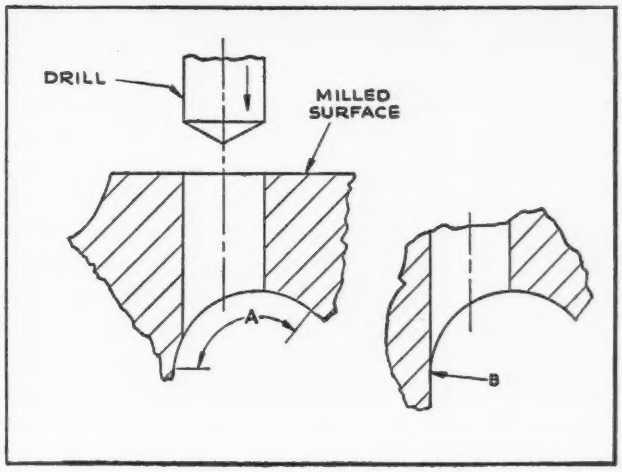


Fig. 3. In spite of the bad working condition illustrated at (B), carbide twist drills produced 750 to 1000 holes between sharpenings

feeds. These particular carbide twist drills have not as yet proved satisfactory in the drilling of steel and are not recommended for that purpose. For steel, modified gun drills, such as the "all-depth" type of drill, are preferable. For holes above 1 3/4 inches in diameter, carbide trepanning tools offer highly interesting possibilities for faster drilling of steel.

It is believed that the statements on production of holes per grind, drill life, etc., in this article are quite conservative. They are based on actual production conditions. Of course, much better results have actually been obtained with carbide twist drills. Fig. 3 shows a set-up where the drill entered a cast-iron part on a clean surface but left the cut through a rough, scaly, and sand-impregnated surface *A*. In some cases, a slight shifting of the cored surface caused the troublesome condition shown at *B*, which placed excessive wear on the drill lips next to the drill margins. The carbide-tipped twist drill applied to this job, operating at double the speed for steel drills, produced 750 to 1000 holes per drill grind, in spite of the bad working condition at *B*.

* * *

"Pancake" Type Automotive Engines Made in the Netherlands

An Amsterdam firm is producing the first twenty bus chassis of a type that is equipped with a "pancake" Diesel engine, which, as the name implies, is a flat or horizontal power unit. By mounting the "pancake" engine under the chassis, between the axles, much more space is available for passengers. The engine develops 120 B.H.P. at 2000 R.P.M., and is the first flat Diesel engine to be made in Holland.

THE SALES ENGINEER AND HIS PROBLEMS

By BERNARD LESTER
Lester and Silver
Sales Management Engineers
New York and Philadelphia

Sell and Sell and Sell

JIBES—even cat calls—might today greet the injunction "Sell and sell and sell" directed at a group of machinery salesmen. "You're crazy," some might even say. "Sell what? When I open my mouth, I put my foot into it. Selling is in reverse. Selling is prevention."

As a matter of fact, there never was a time when it was more necessary to "sell and sell and sell." Our perplexity exists because our minds are so closely linked to selling just physical objects—in our case, the machine. After all, selling is molding opinion to an end that benefits the purchaser and ourselves. Sales skill should reach top level as obstacles multiply. Today these obstacles exist in abundance, but they are almost exact opposites of those a year ago. This sudden change have a tendency to leave us confused and frustrated.

Sell what?—The biggest idea every salesman has to sell is good will. This deals with an attitude of mind and emotion. Good will can't be sold according to exact price, delivery, or specification.

First we must take the offensive rather than the defensive. "I can't tell him anything he wants to hear," says the defensive salesman. "My prospect's busy, he doesn't want to see me." Don't stay away from customers. Customers are busy. But they also are human. Their time may be short, but their memory is long. We all lose respect for the man who rushes in when he wants something from us, but is conspicuously absent when our difficulties multiply. Selling good will depends upon a dynamic attitude that is friendly and helpful.

Second to selling good will, sell information. Show the prospect concisely what our industry is up against—the sudden swings from abject poverty in orders to overabundance. Some clever salesmen have these figures on the tips of their tongues, or they may have a simple bar chart. Many prospects don't understand machine tools or their involved creation much better than the majority of congressmen and senators. Sell the position of the industry and all the moves we are aggressively making to meet the seemingly impossible.

Third, sell our engineering skill—technical service—even though it may have little relation to our particular product.

These three elements which constitute establishing good will mark the long-range competent sales engineer.

Sell how?—First make the rounds—continue the calls. Make them briefer, of course, and more pointed. Don't miss our old friends, even if only for a handshake and an appropriate question or inquiry as to how we can help him. If we don't watch out, our customers and prospects will say: "Why that crowd, in fact the whole machinery industry, has gone 'brass hat.'"

Second, don't dodge the difficult situation, now commonly marked by long delivery. Meet it by digging into all factors surrounding the anticipated purchase. One unfortunate salesman recently remarked: "Well that's the delivery date my boss gave me. It's the best he said he could do." Another, under similar circumstances, dug into the over-all needs of the purchaser's project. He not only demonstrated his interest in the problem, but uncovered the fact that the project involved even hotter spots than he was facing. Steel was needed by the prospect, as well as cranes and specialized heat-treating equipment. All these items required longer deliveries than the salesman's own tools. In the prospect's eyes, this long delivery now appeared of much less importance.

These are times—more than ever—in which our job is to "sell and sell and sell." Fortunately,

most live sales managers are recognizing that fact. They are not laying us off, or using our talents in other directions, as was common during World War II. Build up that storage tank of customer respect and desire. It will yield orders that we will surely need later.

* * *

Gisholt Balancing School

The first class recently completed the three-weeks balancing machine course conducted by the Gisholt Machine Co., Madison, Wis. This course, as announced in April MACHINERY, was organized to train maintenance men, process engineers, and other persons using balancing machines in the fundamentals of balancing and the care and operation of balancing machines. Two courses are offered—one on the Type S machine, of two weeks duration, and the other on the Type U machine, lasting three weeks. Dates announced for the Type U course are June 11 to 29 and August 6 to 24; for the Type S course, July 9 to 20 and September 10 to 21. Actual shop work on maintenance and machine set-up and operation are included in the course. Those interested in taking these courses can obtain further information by writing the company at the address given above.

Ryerson Helping Customers to Get Defense Work

A plan designed to help their customers who are seeking defense work has been announced by Joseph T. Ryerson & Son, Inc., steel distributors. For many years, the Ryerson company has published a pictorial type newspaper which is circulated nationally to firms in all lines of business. Now, for the first time, space will be made available in that paper for insertion of classified advertisements for (1) prime contractors who have work to sub-let and are looking for shops that can handle it, and (2) shops that have open time and are seeking defense work on a sub-contract basis.

Ryerson customers are invited to use the new classified advertising section without charge. This plan has the encouragement and approval of the National Production Authority. Those interested can obtain further information by writing to the Publicity Division of the company, Box 8000-A, Chicago 80, Ill.

* * *

Private automobiles in the United States travel approximately nine times more passenger miles per year than buses and railroads combined.

Fifteen members of the Industrial College of the Armed Forces—one of several groups touring the nation to make first-hand studies of America's industrial strength—recently visited the Pratt & Whitney Division of Niles-Bement-Pond Co. at West Hartford, Conn., selected because it was considered representative of the machine tool and gage industries in the Northeast. Of primary interest to the visitors were manufacturing facilities, plant operations, and discussions with company officials and plant executives regarding problems of normal operation and defense mobilization. Seen seated at the center of the group is the host, Frederick U. Conard, president of the Niles-Bement-Pond Co.

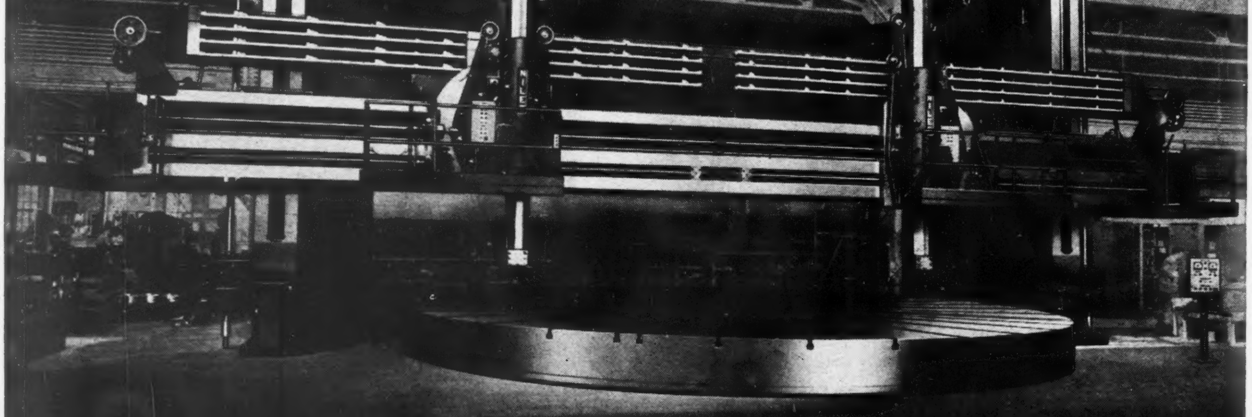
LATEST DEVELOPMENTS IN *Shop*

Niles Giant Size Vertical Boring Mill

The Baldwin - Lima - Hamilton Corporation, Hamilton, Ohio, has just completed a new Niles vertical boring and turning mill which is said to be the largest machine of this type ever built in the United States. This giant size machine has a maximum swing of 43 feet 5 inches, a table 33 feet in diameter, and a maximum height under the tools of 12 feet 2 inches. The machine has a total length (over the operator's platforms at each end of the cross-rail) of 65 feet, a total height of 25 feet, a bed that extends 9 feet 6 1/2 inches below the top of the table, and a weight of 1,250,000 pounds. It is being shipped to Italy, where it will be used primarily for turning water-power generator and turbine parts.

The table is 3 feet thick and is made in three sections to facilitate shipment. It is rotated by a 20-degree helical gear approximately 24 feet in diameter. This gear has 288 teeth of 1 diametral pitch and is cast in halves, which are joined on the 20-degree helical angle. A wide track of large diameter, flooded by oil under pressure, provides ample support for the table, which is driven by two pinions located 180 degrees apart. The pinions, in turn, are driven by two direct-current motors of 50-75 H.P., which are balanced electrically to equalize the drive. Back-gears built into the drive mechanism of each motor provide a table speed range of 0.125 to 5 R.P.M. The back-gear clutches are shifted simultaneously by electric motors operated by means of control buttons. The drive motors and all drive shafts are vertically mounted and run on anti-friction bearings.

A 30-H.P. motor on the cross-brace drives four vertical screws which elevate the cross-rail. Four 3/4-H.P. motors clamp the cross-rail to both the inside and outside of each housing. Elevating and clamping mechanisms are electrically interlocked.



Giant size boring mill for turning water-power generators and turbines, built by the Baldwin-Lima-Hamilton Corporation

To obtain additional information on equipment described here, use Inquiry Card on page 229.

Equipment

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on Market

Edited by FREEMAN C. DUSTON

The forged-steel octagonal-form boring-bars measure 12 inches across flats and have a travel of 9 feet. These bars slide on renewable bronze plates. Sixteen mechanical feeds are provided for traversing the saddles along the cross-rail or for traversing the bars vertically or at any angle up to 30 degrees either side of the vertical position. Feeds range from 0.01 millimeter to 32 millimeters per revolution of the table, and are obtained from the drive on each side of the machine.

Power rapid traverse to each bar and saddle is provided by 10-H.P. motors at the rear of each end of the cross-rail. Selection between bar and saddle, and between feed and rapid power traverse, is made by levers on the heads or at the ends of the cross-rail. The bars and saddles can be hand adjusted by automatic releasing hand ratchets, which can be operated at any position between the end of the cross-rail and the saddle. Direct reading micrometer dials, graduated in sixteenths and thousandths of an inch, are mounted on the heads for the bars and saddles.

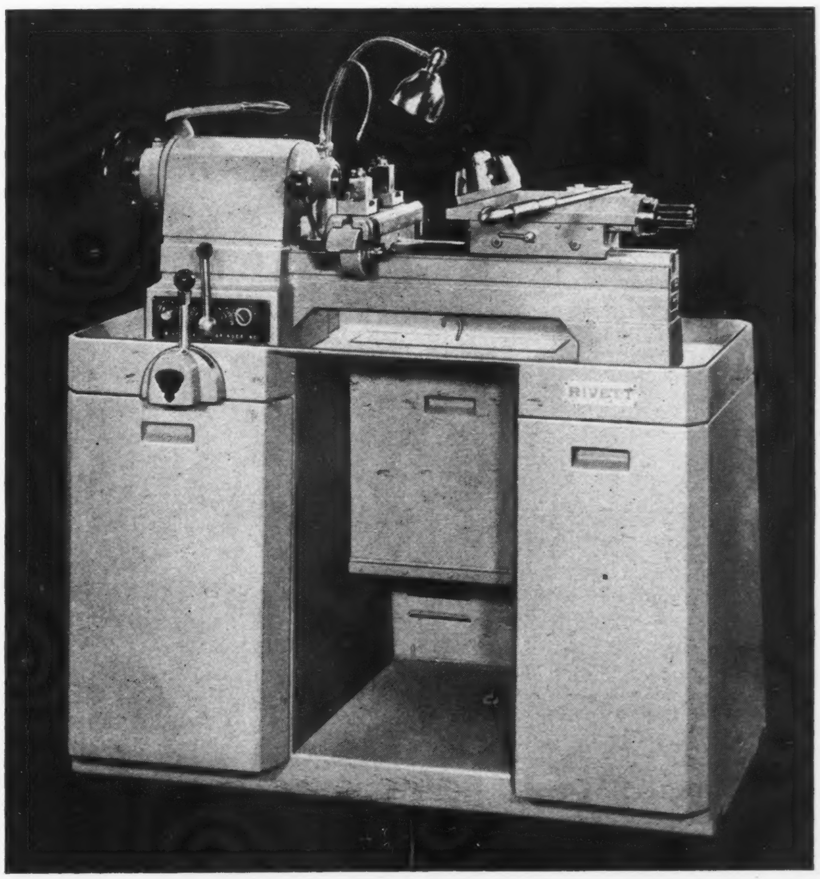
Safety friction clutches in the feed and traverse mechanism prevent breakage if the heads are run together or the bars are run against the work. The bars are electrically clamped when the saddles are being fed, and the saddles are electrically clamped when the bars are being fed.

Operator's platforms are built on each head, at each end of the cross-rail, at the rear of the cross-rail, and on the cross-brace. Lubrication of all running parts is automatic. A 150-K.W. direct-current generator, driven by a 250-H.P. alternating-current motor, provides power for the direct-current motors. 45

Rivett Precision Turret Lathe

A turret lathe of tool-room precision is being placed on the market by Rivett Lathe & Grinder, Inc., Boston, Mass. Power, speed, and accuracy are outstanding features of this 9-inch swing machine, designed for the rapid production of small duplicate parts to interchangeable limits. Well grouped controls permit instant selection of cutting speeds from 90 to 3750 R.P.M., and an automatic chuck-closer controls the spindle drive and brake. The spindle is dynamically balanced on precision grease-sealed ball bearings mounted to eliminate thermal stresses.

Collets with double the usual bearing spacing are designed to provide maximum precision and increased gripping power. The draw-in collet capacity is 1 1/8 inches, and the capacity of the stationary collet is 7/8 inch. The closing action is accomplished without lateral movement of the spindle, which prevents scarring



Rivett turret lathe designed for precision tool-room work

To obtain additional information on equipment described here, use Inquiry Card on page 229.

of the stock. The self-aligning slide-rest is automatically lined up with the lathe centers. Hardened and ground double-bevel steel ways insure positive centering.

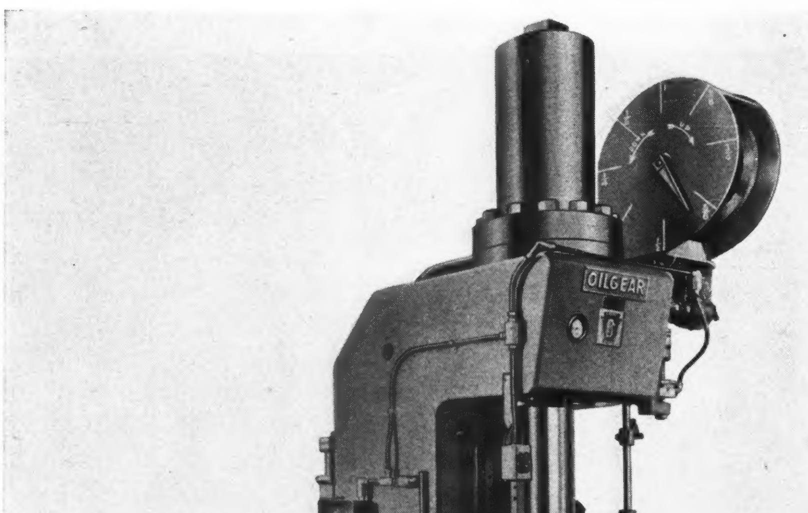
The automatic indexing turret revolves on a ball thrust bearing, with constant preload opposed by a taper roller bearing to prevent errors in vertical alignment. The locating and locking index-pin engages jig-ground holes on the index-plate to prevent lateral alignment errors. 46

Special Oilgear Press for Straightening Large Steel Pipes

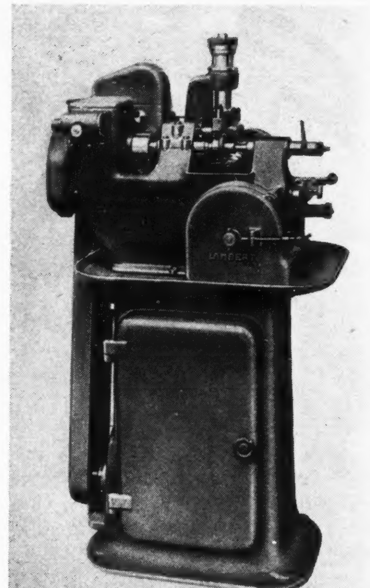
Integral-joint steel casings or pipe and tubing, in sizes from 2 3/8 to 10 3/4 inches outside diameter and having a yield strength up to 125,000 pounds per square inch, can be "squeeze straightened" in the anvils of a special 200-ton press brought out by the Oilgear Co., Milwaukee, Wis. Features of the press include semi-automatic push-button control; independently variable pressing and return speeds; selection of higher speeds for operation at half-tonnage capacity; remote, direct reading push-button stroke adjustment; guided 12- by 16-inch ram nose; and 72-inch long table with dual T-slots.

The Oilgear two-way variable-delivery pump is direct-connected to a 125-H.P., 1500-R.P.M. electric motor through a speed reducer. When set for a 4-inch ram travel, the press will operate at speeds up to 30 cycles at half tonnage and up to 21 cycles at full tonnage. It has a stroke of 20 inches; daylight height of 35 1/4 inches; and a 12-inch throat depth.

The maximum downward speed of the ram when operating at full-tonnage capacity is 188 inches per minute, and at one-half tonnage capacity, 393 inches per minute. The maximum upward speed of the ram is 362 inches per minute. The press requires a floor space of 128 by 112 inches, and weighs 37,100 pounds. 47



Large pipe-straightening press brought out by the Oilgear Co.



Lambert semi-automatic gear-hobbing machine introduced by the Carl Hirschmann Co.

Lambert Semi-Automatic Gear-Hobbing Machine

A new semi-automatic gear-hobbing machine manufactured by S. Lambert S.A., Soleure, Switzerland, is now available from the Carl Hirschmann Co., Manhasset, N. Y. This Type 75 machine is designed specifically for cutting gears with straight teeth; gears with teeth inclined up to an angle of 18 degrees; worm-wheels (cut radially); and, by the use of a special attachment, bevel gears with straight teeth. It has a patented automatic radial and longitudinal feed.

The machine will cut gears having a minimum diameter of 5/64 inch and a maximum diameter of 3.470 inches with a hob 0.9449 inch in diameter. With a hob 1.260 inches in diameter, it will cut gears up to 3.149 inches in diameter. The maximum length of straight gears that can be hobbed is 1.969 inches, and of gears with inclined teeth, 1.181 inches at a maximum inclination of 18 degrees.

Other capacity ratings are: Maximum module, 1.5; number of teeth, 4 to 390; four hob speeds of 214 to 940 R.P.M.; ten feed speeds ranging from 0.075 to 0.80 millimeters; motor size and speed, 0.7 H.P., 1500 R.P.M.; floor space required, 32 by 22 inches; and weight of machine on pedestal, including motor, 900 pounds. 48

To obtain additional information on equipment described here, use Inquiry Card on page 229.

"Hypro" Vertical Boring and Turning Machines of Improved Design

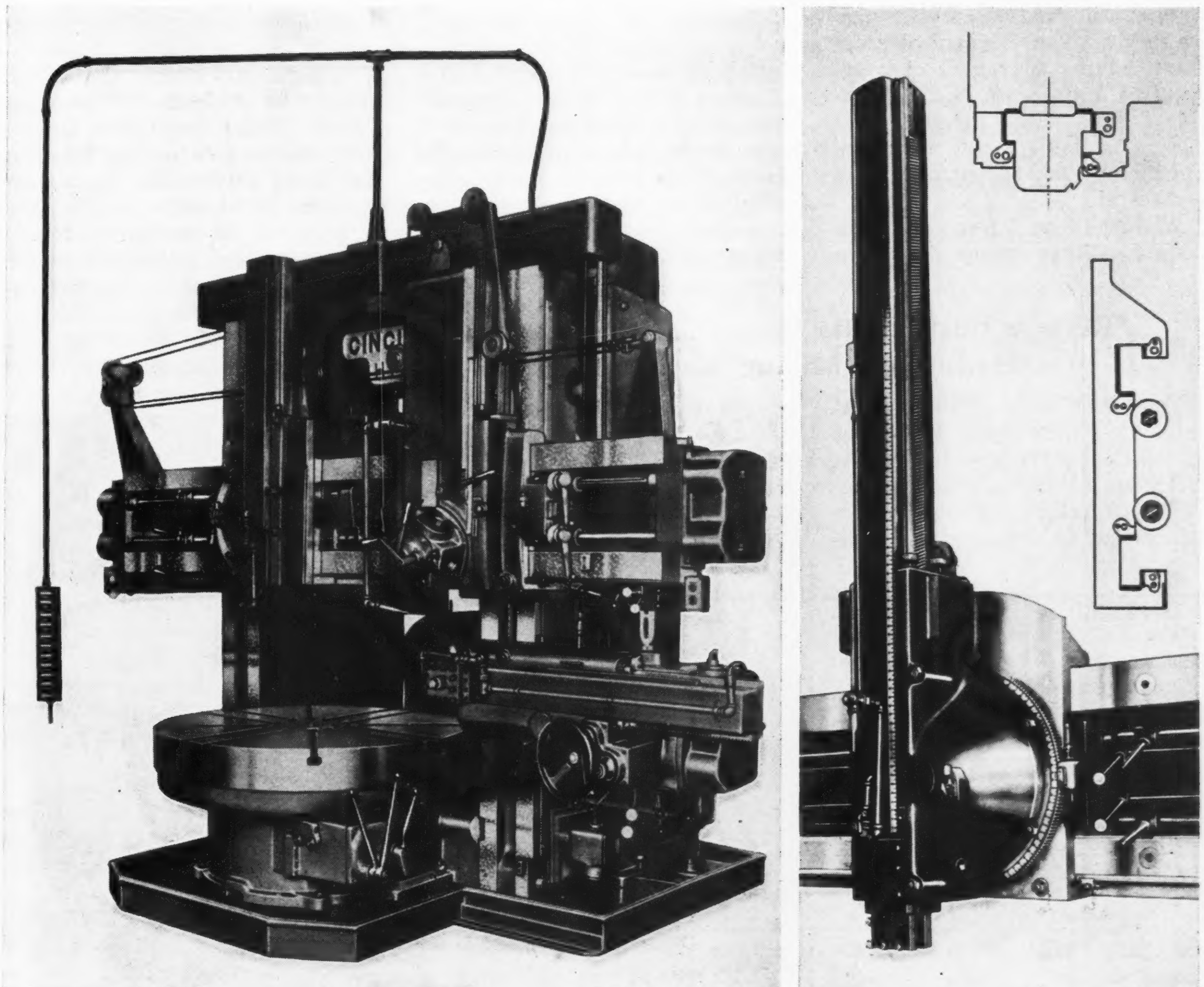
Important design improvements have been incorporated in the line of "Hypro" vertical boring and turning mills built by the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis. The new features include non-metallic bearings for ram and saddle; independent traverse motors for rail- and side-heads; swivel type pendent control; helical rack and pinion on the ram; clearly marked feed controls; anti-friction bearing table transmission; new sixteen-feed gear-box; anti-friction thrust and load bearings for the table; two arrangements of mechanical change-gear drives; and three electrical arrangements for single-shift drives.

The application of non-metallic bearings to the ram and saddle, as indicated by the black areas in the views in the upper right-hand corner of Fig. 2, is an important departure in "Hypro" machine construction. This improved bearing arrangement is said to insure precision operation under the most severe service. These bearings are resistant to the abrasive action of metal dust, forging scale, and sand from improperly cleaned castings. Also they are unaffected by transfer and residual heat, which may distort solid metal bearings and influence the accuracy of machining.

The pendent station swivels to any desired position near the rail- and side-heads, enabling the operator to watch the part being machined with safety. On gear-change drive machines, complete head and rail control and start, stop, and "inch" functions are available at the pendent. On single-shift drive machines, these functions, in addition to remote table speed control, are included. The latter control enables the operator to select the exact cutting speed desired.

Sturdy construction of rail heads, mounted on extra long full bearing swivel and saddle, provides unusual rigidity at any point of the ram travel. A new type helical rack and pinion is used to improve feed movements when threading or drum scoring. Fine adjustment is possible by means of hand-cranks on the 54- and 64-inch machines, and by sliding fine adjustment handles on the feed-shafts and rail screws of larger machines.

The table transmission case is an integral part of the one-piece machine bed. Anti-friction bearings maintain precision alignment of the hardened spur and helical



(Left) "Hypro" vertical boring and turning mill with new features developed to increase accuracy and range of operations. (Right) View showing helical rack and pinion used to assure smooth, even feed of ram on "Hypro" machine shown at left, and diagrams indicating how non-metallic bearings are used in ram and saddle assembly

To obtain additional information on equipment described here, use Inquiry Card on page 229.

gears which run in a constant spray of filtered oil.

The new feed-box provides sixteen feeds ranging from 0.003 to 0.500 inch on 54- and 64-inch machines, and from 0.004 to 0.750 inch on 6-foot or larger machines. The flame-hardened gears are easily removed from the hardened shafts. All shafts rotate in anti-friction bearings. The feed-box is readily accessible for rapid gear change-over.

A large anti-friction taper roller bearing offsets table radial thrust, and a heavy-duty roller bearing track supports the table and load, making it possible to operate the machines at highly increased speeds and utilize carbide tools to full advantage.

Two arrangements of mechanical change-gear drives are available. In the main drive, table speed variation is obtained through sixteen mechanical gear changes. Power for this drive is provided by a 1200-R.P.M., 40- to 50- or 60-H.P. alternating-current motor. A similar mechanical main drive, having four gear changes, requires a 40- or 50-H.P. adjustable 3 to 1 speed direct-current motor for table speed variation. The motor speed is controlled with a rheostat.

With the 3 to 1 heavy-duty adjustable-voltage motor drive, infinitely variable table-speed drives of 20 to 1 ratio in two separate ranges are obtainable. The 6 to 1 extra heavy-duty adjustable-speed motor drive has the same table-speed drive ratio. A third arrangement is the 6 to 1 adjustable-speed direct-current drive...49

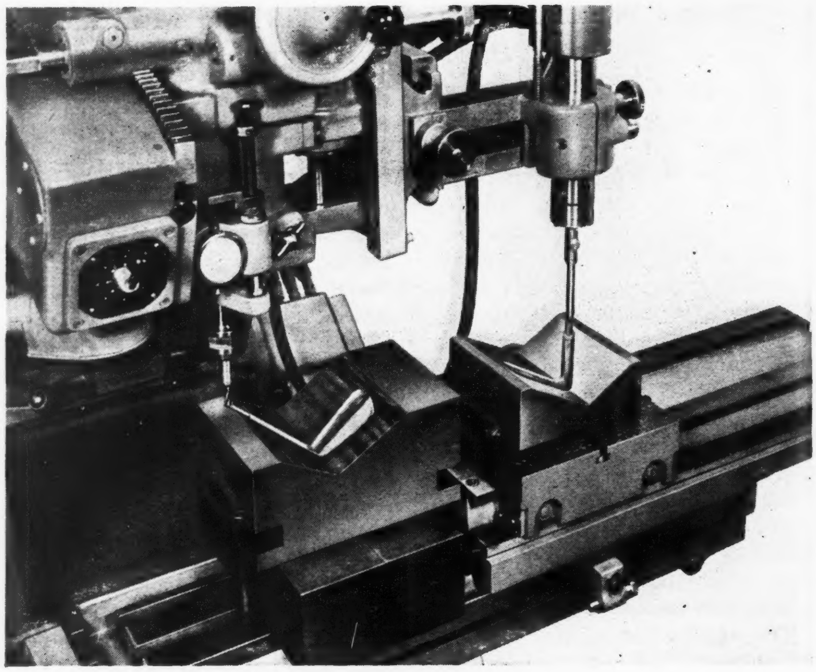


Fig. 1. Cincinnati tool and die miller equipped with new "reverse image" attachment for making dies, molds, and hobs from masters of the opposite hand. Illustration shows set-up for milling golf club dies

"Reverse Image" Attachment for Cincinnati "Hydro-Tel" Milling Machines

The Cincinnati Milling Machine Co., Cincinnati, Ohio, has brought out a "reverse image" attachment for its vertical "Hydro-Tel" type milling machines. This attachment is employed for milling right- or left-hand dies, molds, and hobs from masters of the opposite hand. Thus, both right- and left-hand matching halves of a die can be accurately milled from one master.

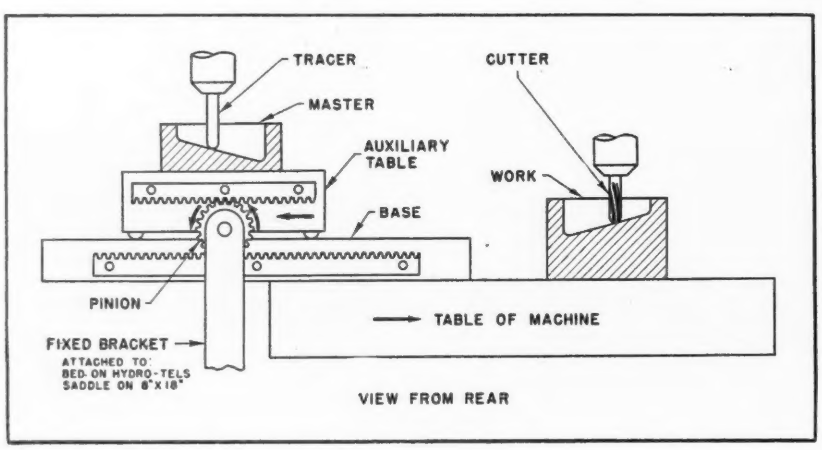


Fig. 2. Diagram illustrating operating principle of "reverse image" attachment shown in Fig. 1

Attachments are available for the 8- by 18-inch tool and die miller, 16-inch vertical "Hydro-Tel," and 28-inch vertical "Hydro-Tel." All sizes of the attachment function in the same manner. The attachment is designed to be mounted at the right-hand end of the machine table, under the vertical depth control unit. It consists of a rigid supporting base which carries an auxiliary table on anti-friction rollers.

At the rear of the attachment, two matched racks, one on the supporting base and one on the auxiliary table, engage a gear which is carried by a fixed bracket, as shown in Fig. 2. The gear acts as an idler between the two racks, movement of the machine table in one direction causing an equal movement of the auxiliary attachment table in the opposite direction. Therefore, a master shape mounted on the auxiliary table will be reproduced in the die block, but to the opposite hand.

The attachment table for the tool and die miller is 9 1/4 by 9 1/4 inches and has two 7/16-inch T-slots. The height above the machine table is 5 1/8 inches and the total length is 25 3/4 inches. Overhang from end of machine table to end of attachment ways is 8 5/8 inches. The maximum length of cut is 8 inches, and the net weight, 100 pounds.

To obtain additional information on equipment described here, use Inquiry Card on page 229.

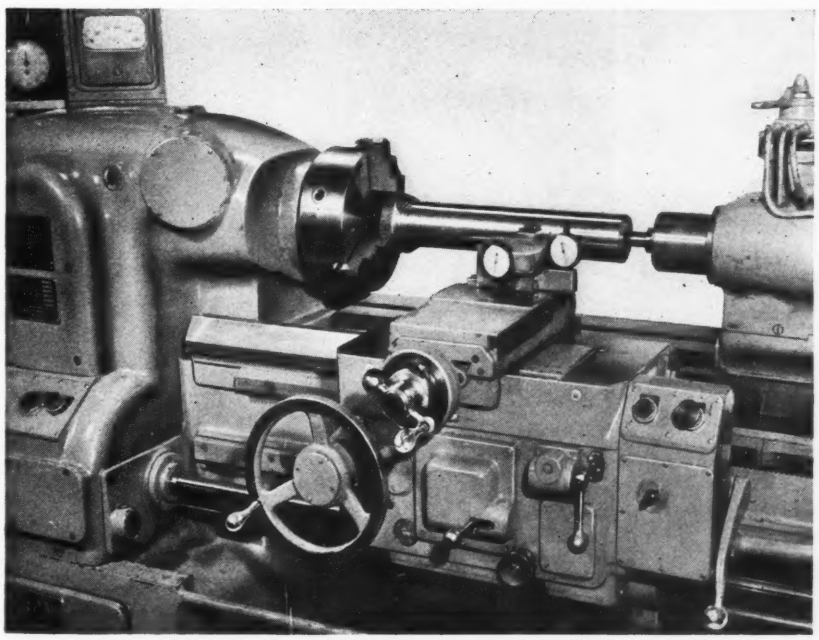
The attachment table for the 16-inch vertical "Hydro-Tel" is 16 by 16 inches and has three 11/16-inch T-slots. The height above the machine table is 11 inches and the total length 44 inches. Overhang from end of machine table to end of attachment ways is 26 1/2 inches. The maximum length of cut is 14 inches. The net weight of this attachment is approximately 500 pounds.

The attachment table for the 28-inch vertical "Hydro-Tel" is 28 by 28 inches and has three 13/16-inch T-slots. The height above the machine table is 15 inches and the total length 80 1/2 inches. Overhang is 30 inches and maximum length of cut 26 inches. The net weight of the complete attachment is 2250 pounds. 50

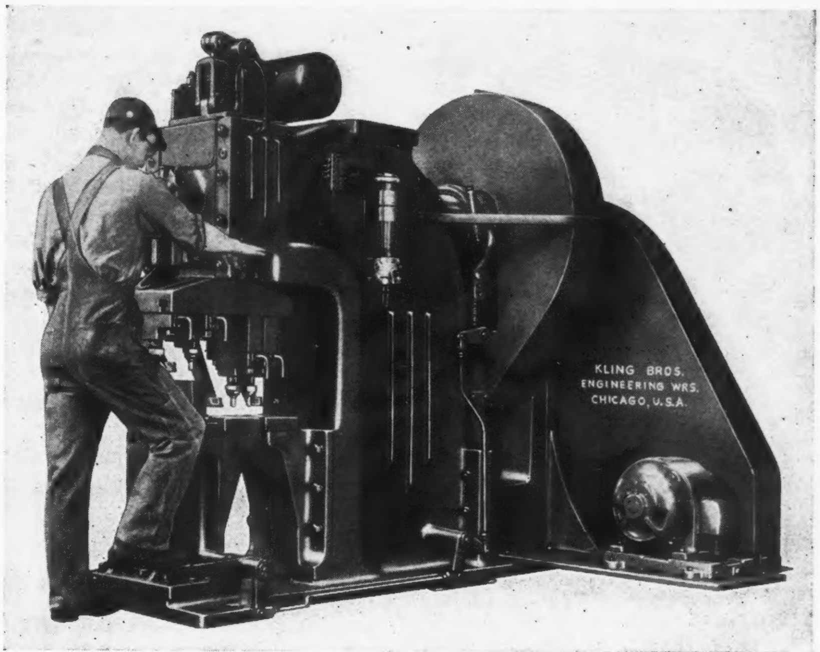
Monarch Lathe Equipped for Machinability Tests

A specially equipped lathe has been developed by the Monarch Machine Tool Co., Sidney, Ohio, for machinability research work now being conducted by the Curtiss-Wright Corporation, under contract from the United States Air Force. The lathe has a variable-speed drive for testing at any specific surface cutting speed within its capacity range and is accurately calibrated for net cutting power.

The spindle speeds of this lathe have been stepped up from the normal range of 130 to 3000 R.P.M. to a maximum of 6000 R.P.M. through special gearing and the use of a 20-H.P. variable-speed drive. Other features of the lathe include a stationary, single-point tool, which simplifies instrumentation; and provision for using round bar stock test pieces, which are the least expensive and easiest form to obtain in the majority of materials tested. They are also the easiest to heat-treat uniformly. 51



Specially equipped lathe developed by Monarch Machine Tool Co. for machinability research work



Universal punch added to line of Kling Bros. Engineering Works

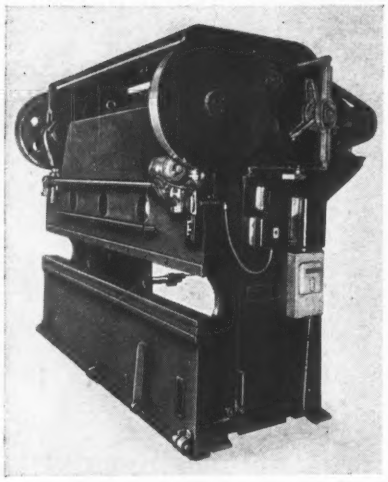
Kling Universal Punch

Kling Bros. Engineering Works, Chicago, Ill., has designed a universal punch as a companion machine for the No. 12 model previously introduced. The new punch was developed in response to the demand for an open-end beam type punch similar to the larger unit. It has a rating of 118 tons, weighs approximately 18,000 pounds, and, without motor, requires a floor space of 118 by 36 inches. A 7 1/2-H.P. motor drives the flywheel through V-belts. The machine has a capacity for punching a 1 1/4-inch hole through 1-inch material in the center of the ram, and a 1 3/16-inch hole through 3/4-inch material at 10 1/2 inches from the center of the ram.

The punch is equipped with three high die-blocks, two low die-blocks, and two gooseneck die-blocks. This equipment enables the operator to punch the flanges and webs of beams and channels from 3 to 30 inches wide. In most cases, the web and flange punching can be done without changing set-ups.

H-beams, I-beams, angles, and other structural shapes can all be handled by this universal punch. Because of its open throat, plates of any size, within the capacity of the machine, can also be punched. Lubrication is effected by oil-cups or by a manually operated one-shot system. 52

To obtain additional information on equipment described here, use Inquiry Card on page 229.



Press brake recently brought out by the Struthers Wells Corporation

Struthers Wells New Line of Press Brakes

A line of press brakes has just been added to the industrial equipment and machinery manufactured by the Struthers Wells Corporation, Titusville, Pa. The 8-foot, 100-ton machine shown in the accompanying illustration is equipped with an extra large clutch and brake for instantaneously stopping the ram at any desired position. As the clutch and brake function simultaneously, the operator is afforded complete control of the press brake at all times. Either the clutch or brake can be easily removed without disturbing other parts. The ram can be positioned accurately by push-button control. Each connecting screw is provided with a micrometer adjustment and scale indicator.

Accurate forming and coining operations, with deflection held to a minimum, are made possible on the new press brakes by patented construction, which includes an extra heavy steel frame. The eccentrics are carried on two large bearings, each of which is backed up against the frame.

The alloy-steel high-speed gears are heat-treated and machined with a special tooth form. Shafts are mounted in anti-friction bearings and run in an oil bath.......53

Fosdick Radial Drill with Super-Finished Column

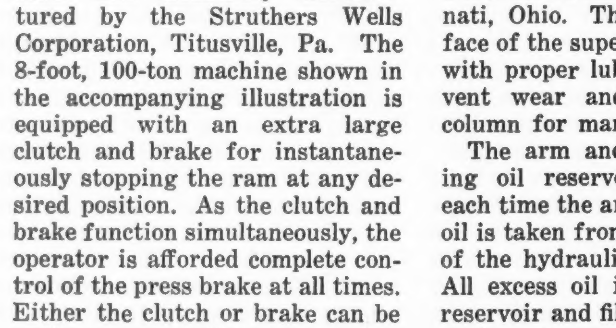
Super-finished columns are a new feature of the hydraulic radial drills manufactured by the Fosdick Machine Tool Co., Cincinnati, Ohio. The mirror-like surface of the super-finished columns, with proper lubrication, will prevent wear and scoring of the column for many years.

The arm and column lubricating oil reservoir is replenished each time the arm is elevated. The oil is taken from the pressure side of the hydraulic elevating motor. All excess oil is returned to the reservoir and filtered before using again. The arm is provided with a Neoprene wiper and a felt oil distributor to clean and lubricate the column and thus prevent scoring. 54

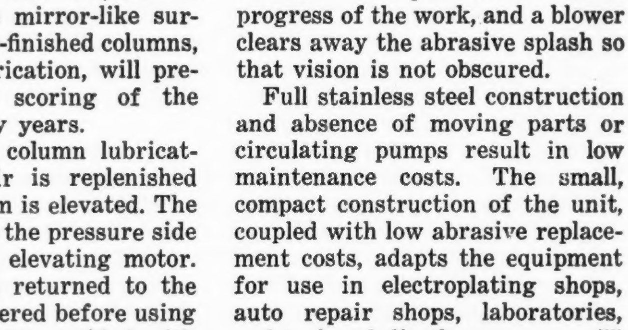
Bench Model Wet Type Abrasive Blasting Machine

A wet type low-cost abrasive blasting machine designed for rapid finishing of all types of metal parts and tools is being manufactured by the Cro-Plate Co., Inc., Hartford, Conn. The new bench model blaster, called the "Cro-Hone, Jr.," produces a clean base on the work which is suitable for plating or painting. It uses a fine abrasive suspended in a water carrier, which is forced against the metal parts by air pressure through a siphon jet gun. The work, which is inserted through the front window, is held in one hand, while the gun is held in the other. A clear-view window enables the operator to watch progress of the work, and a blower clears away the abrasive splash so that vision is not obscured.

Full stainless steel construction and absence of moving parts or circulating pumps result in low maintenance costs. The small, compact construction of the unit, coupled with low abrasive replacement costs, adapts the equipment for use in electroplating shops, auto repair shops, laboratories, and tool and die shops. 55



Radial drill with super-finished column introduced by Fosdick Machine Tool Co.



Wet type abrasive blasting machine brought out by the Cro-Plate Co., Inc.

To obtain additional information on equipment described here, use Inquiry Card on page 229.

Morse "Hy-Vo" Transmission Chain Drive

The Morse Chain Co., Detroit, Mich., has announced a revolutionary power transmission chain drive. This development, featuring entirely new design principles and called the "Hy-Vo" (high velocity) chain drive, provides a power transmitting medium that is said to combine the ruggedness and dependability of a gear drive with the smoothness and lack of vibration of a belt drive.

This new drive makes possible single units capable of transmitting as much as 5000 H.P. at linear speeds up to 6500 feet per minute, or rotating speeds up to 3600 R.P.M. A "Hy-Vo" drive only 2 inches wide, for example, has transmitted as much as 500 H.P. The two "Hy-Vo" 2-inch pitch, 12-inch wide drives shown in the illustration transmit the tremendous power required for drilling 20,000-foot deep oil-well holes with power furnished by a 1500-H.P., 600-R.P.M. Diesel-electric portable unit.

"Hy-Vo" drives are not intended to replace present Morse roller or silent chain drives, but rather to supplement them. They are designed specifically for higher speed applications than conventional chain drives, and to replace unwieldy belt drives now required for high-speed power transmission. At present "Hy-Vo" drives are being produced in 1-, 1 1/2-, and 2-inch pitches, in the chain widths in greatest demand.........56

Improved G-E Induction Heater

An improved electronic type 20-K.W. induction heater, featuring a non-ventilated, dustproof, NEMA Type 12 enclosure, has been placed on the market by the General Electric Co., Schenectady, N. Y. This heater is adapted for use in high - speed annealing, brazing, hardening, and soldering, and is so designed that only the control and accessories required for a particular heating application need be purchased.

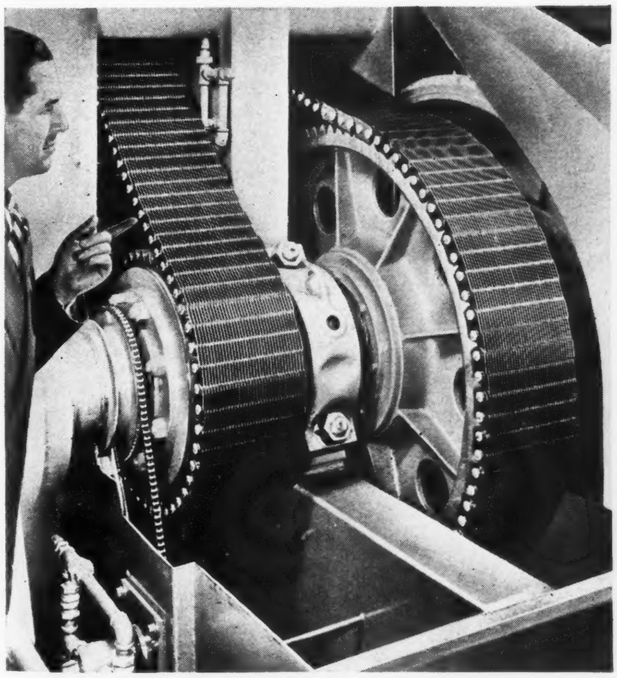
The cabinet is equipped with felt-gasketed and bolted doors to protect the components from dirt, grit, or oily vapors, thus reducing maintenance costs and providing a minimum of "down time." Long-scale, switchboard type instruments provide improved readability, enabling the operator to determine operating characteristics quickly and accurately.

The heater can be used for long- or short-run production, and is available in two models—with or without variable - power adjustment. For short-run production of a wide variety of parts, the Type HM-20L1 heater is recommended. This model has variable-power adjustment from 0 to 100 per cent by means of a rheostat, either mounted in the work-table or supplied separately for mounting elsewhere. It enables rapid "on-off" heater operations to be performed for accurate hardening of selected areas.

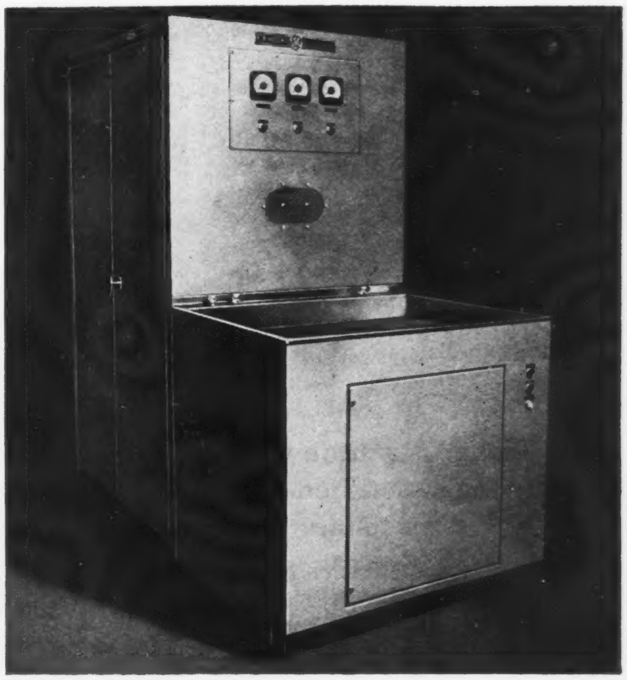
For long-run, higher-production applications which do not have rapid cycling, the Type HM-20L2 heater without variable-power adjustment is recommended. When this heater is initially set to heat a specific part, no further adjustment is necessary. The complete heater, in either model, weighs approximately 3600 pounds. Units are available for operation on 230-, 460-, or 550-volt, three-phase, 60-cycle power supply.....57

Threading Time Calculator

A simplified slide-rule, designed to estimate threading time on the "Cri-Dan" single-point semi-automatic high-speed threading machine, is now available from the Lees-Bradner Co., Cleveland, Ohio. It covers the wide range of work handled by the "Cri-Dan" machine, including internal or external, right- or left-hand, straight or tapered threads of any profile, all produced with a simple single-point carbide or high-speed steel tool. 58

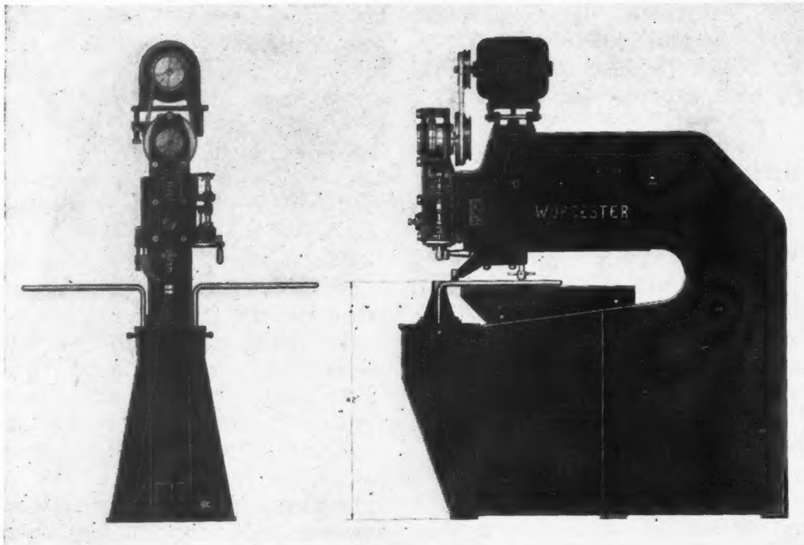


"Hy-Vo" drive developed by Morse Chain Co. for high-speed heavy-duty power transmission



Improved induction heater placed on the market by the General Electric Co.

To obtain additional information on equipment described here, use Inquiry Card on page 229.



Nibbling machine designed for rapid cutting of metal sheets brought out by the Arduini Mfg. Corporation

Worcester Nibbling Machine

A new nibbling machine designed for rapid, accurate, and economical cutting of sheet metal has been announced by the Arduini Mfg. Corporation, Worcester, Mass. This nibbler is designated the "Worcester" and is said to embrace certain engineering improvements that make it extremely efficient. Features of this machine include a two-speed drive and variable-stroke adjustment to accommodate different thicknesses of metal.

Straight or contour cutting is accomplished at the rate of 1200 punch strokes per minute. Circles can be cut with rapidity and accuracy. The exceptionally clean edges produced by this nibbling machine reduce finishing operations to a minimum. There is claimed to be no distortion of material. The machine is made in two sizes—one for handling up to 3/16-inch low-carbon steel and the other for handling up to 5/16-inch low-carbon steel. 59

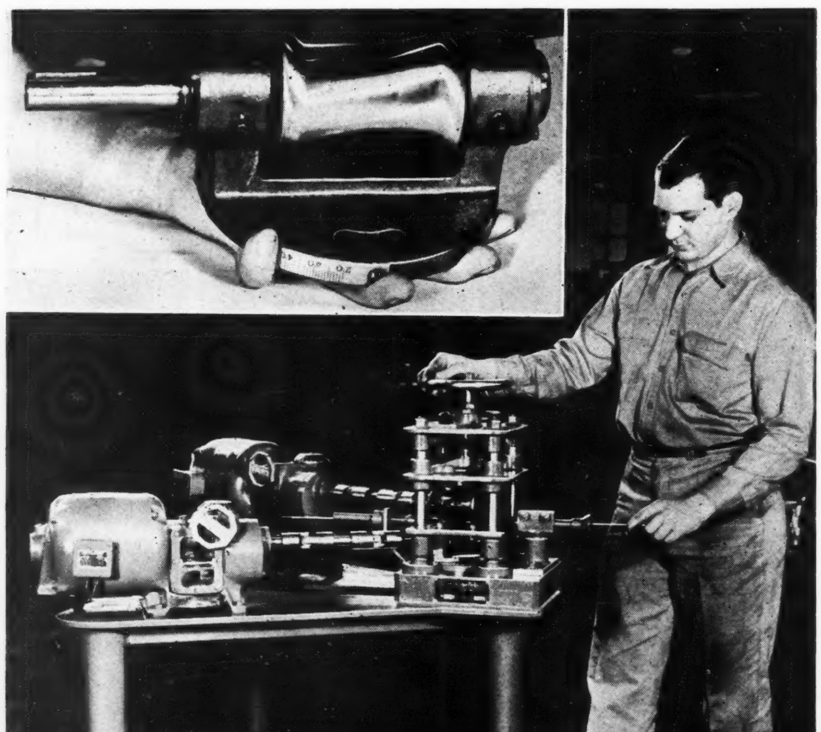
Huge Keller Machine with Wear-Resistant Phenolic Liners for Slides

Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford, Conn., has announced that scoring and wearing of the bearing slides, with consequent loss of accuracy, have been overcome on the huge P & W Keller type BG-22 tracer-controlled milling machine by the use of phenolic liners, which eliminate the troublesome iron against iron bearing surfaces.

Laminated phenolic plates, cut edgewise to present end-grain wearing surfaces, are fastened to the slides of the column base, vertical slide, and spindle head. These plates are pinned securely to the castings with phenolic pins, and their surfaces planed and precision-scraped to fit the mating slides with the same limits of accuracy as were the cast-iron bearings. The lead-screws which drive these heavy members also have molded phenolic nuts, which give a positive contact fit that will not freeze. 60

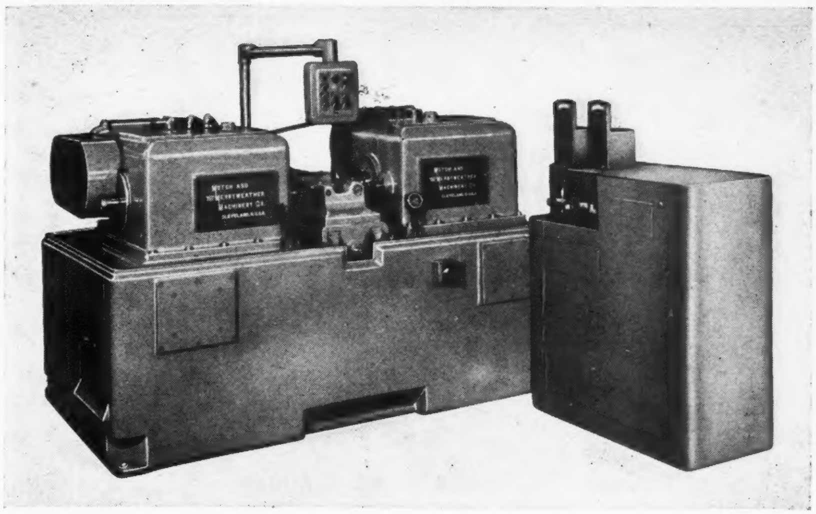
Medart Rotary Straightener

The Medart Co., St. Louis, Mo., has developed a small rotary straightener (designated No. 000 size 2 and 2 universal) for the precision straightening of round material from 1/16 to 3/16 inch in outside diameter. The machine shown in the illustration has individual roll drive from variable-speed motors. The roll yokes, seen in the insert, are made from heavy one-piece castings equipped with Timken tapered roller bearings. .. 61



Rotary straightener for small round material developed by the Medart Co.

To obtain additional information on equipment described here, use Inquiry Card on page 229.



Automatic weight-balance milling machine for connecting-rods announced by Motch & Merryweather Machinery Co.

Motch & Merryweather Milling Machine for Automatically Balancing Connecting-Rods

The Motch & Merryweather Machinery Co., Cleveland, Ohio, in cooperation with the Toledo Scale Co., has produced a new machine for use in the manufacture of interchangeable automotive connecting-rods. This machine automatically performs the final operation on each end of the connecting-rods necessary to obtain accurate balance within limits of 2 grams.

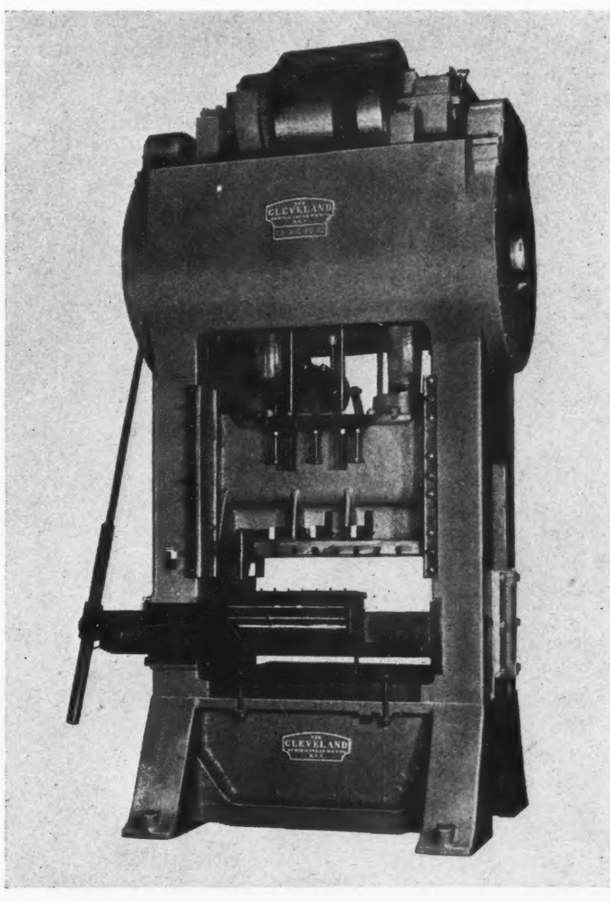
The machining unit consists of two opposed special quill type stationary milling heads and a hydraulically actuated clamping fixture mounted on hardened ways between the two heads. This unit is mounted on a heavy, normalized, welded steel base. The Toledo scale unit is contained in a floor-mounted cabinet, positioned at right angles to the machine, within easy reach of the operator.

To start the weight-balance machining cycle, an over-weight connecting-rod is placed on the scale unit, where each end is individually weighed about the fixed center of gravity and the amount of over weight is mechanically transmitted directly to the machining unit. The connecting-rod is then placed in the fixture of the milling machine and the cycle button pressed.

The locating probes and quills of both milling heads advance, the probes stopping against the work, while the milling head quills advance the additional amount necessary to remove sufficient metal from each end to bring the connecting-rod within weight-balance. At this point, the quills are locked, and the fixture slide is rapidly traversed to the milling cutters and then fed at milling rate until the face milling cutters have removed the extra stock. Next, the milling quill and probes retract, the fixture returns to the starting position, and the work is released.

During the machining cycle, the operator places the next over-weight connecting-rod on the scale unit, the correct data is transmitted from the scale unit to the milling head, where positive mechanical stops are positioned and held until the operator unloads the completed rod and reloads the over-weight rod into the fixture and presses the cycle button.

The production rate is 240 pieces per hour, although the cycle of the machine is arranged to accommodate a higher rate of production, dependent upon the skill of the operator in handling the work. The operation of the fixture slide and the movement of the probes and milling head quills are by hydraulic cylinders. —62



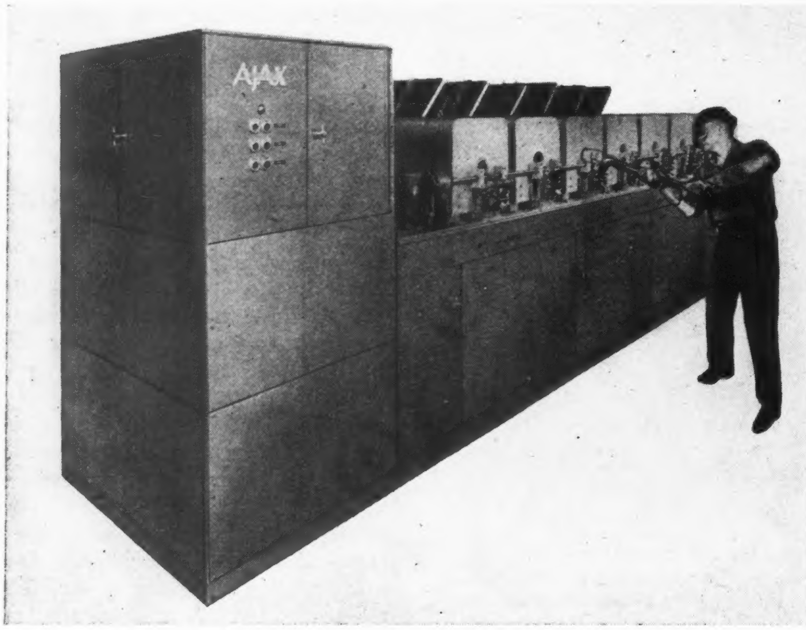
Double-geared, twin-drive press with single roll feed announced by the Cleveland Punch & Shear Works Co.

Press with Roll Feed and Pneumatic Cushion

A new two-point, double-geared, twin-drive press with single roll feed has just been announced by the Cleveland Punch & Shear Works Co., Cleveland, Ohio. This press has an electrically controlled, air-operated, drum type friction clutch with spring-loaded brake, and the bed is provided with a pneumatic cushion.

The press has a stroke of 12 inches; slide adjustment of 8 inches; distance from bed to slide with the stroke down and adjustment up of 42 inches; bed 48 by 60 inches; and slide face 42 by 60 inches. The speed is 22 R.P.M., and capacity 300 tons. —63

To obtain additional information on equipment described here, use Inquiry Card on page 229.



Ajax-Northrup multiple-station induction billet heater with interchangeable heating units

Multiple-Station Induction Billet Heater with Interchangeable Heating Units

New Ajax-Northrup induction heating equipment, which will automatically heat billets in a wide range of sizes and shapes to preselected heating patterns for forging operations, has just been announced by the Ajax Electrothermic Corporation, of Trenton, N. J. Three of the heaters, each with a power range of from 50 to 1500 K.W., 400-800 volts, and 3000 cycles, are now being used for heating steel bar stock for automotive forgings. Billet sizes from 1 to 4 inches, either round or square, can be handled, and are heated to 2250 degrees F. at a maximum rate of 7500 to 8500 pounds per hour.

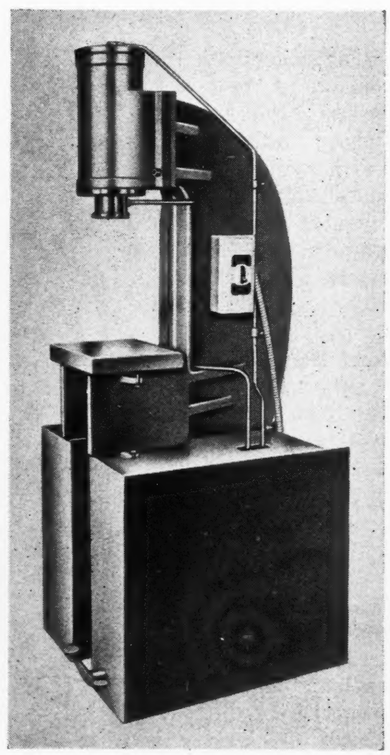
The heaters have space for eight heating stations with some thirty interchangeable units to accommodate the different sizes of bars. Each station has its own transformer, capacitors, push-buttons, signal lights, automatic timers, hydraulically operated billet feeding devices, and protective relays, yet the stations can be arranged to work together in a wide variety of combinations to feed uniformly heated billets to the forge at a rate timed for maximum production.

A feature of this equipment is that each heater station comprises two coils in series. The coils can be operated to eject heated bars automatically or the back heater can be de-energized and the front heater used for bar-end heating. In this case, lights are arranged to signal the operator when to remove the bar manually. The coils draw an average power of about 200 K.W., but since at any given time some are operating at high and others at low power the average power drawn from the equipment as a whole is near its top rating. 64

Ross Motor-Driven Hydraulic Press

Ross & Co., Chicago, Ill., has commenced production of a new motor-driven hydraulic press for assembling, broaching, crimping, drawing, forming, laminating, riveting, and general forcing operations. This press is double acting, and has an 8-inch throat depth and a 12-inch ram travel. The clearance under the retracted ram is 16 inches.

The downward ram speed is 60 inches per minute and the upward speed 90 inches per minute under full load. The ram is controlled by a foot-pedal, and is activated by a vane type pump, set to operate at a pressure of 1250 pounds per square inch. The entire press is of steel welded construction except the cylinder, which is a Meehanite metal casting. The power unit is contained in the base, providing a compact and portable unit occupying a floor space of 28 by 34 inches. 65



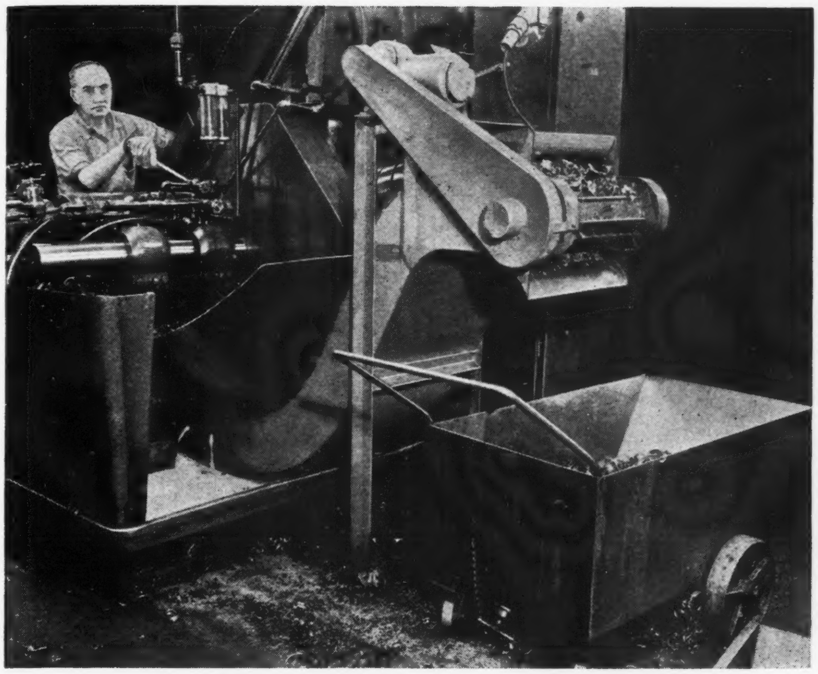
Motor-driven hydraulic press announced by Ross & Co.

Improved "Chip-Tote" Conveyor

An improved scrap conveyor designed for greater capacity and operating safety than preceding models has been brought out by May-Fran Engineering, Inc., Cleveland, Ohio. This "Chip-Tote" unit continuously removes metal chips, borings, and turnings from automatic or multiple-spindle production machines, and eliminates the need for periodic shut-down of equipment for manual scrap removal. A new feature of this conveyor is the formed steel hold-down which meters turnings, chips, and other scrap passing up the conveyor belt.

In operation, this conveyor gradually compresses the materials into a compact, evenly distributed mass to eliminate jamming of the machine and prevent small pieces from falling back. An adjustable clutch has been added to the power source to increase safety of operation. If a load in excess of a pre-set limit is imposed on the conveyor belt, the clutch will slip and thus prevent

To obtain additional information on equipment described here, use Inquiry Card on page 229.



Machine equipped with "Chip-Tote" conveyor of improved design announced by May-Fran Engineering, Inc.

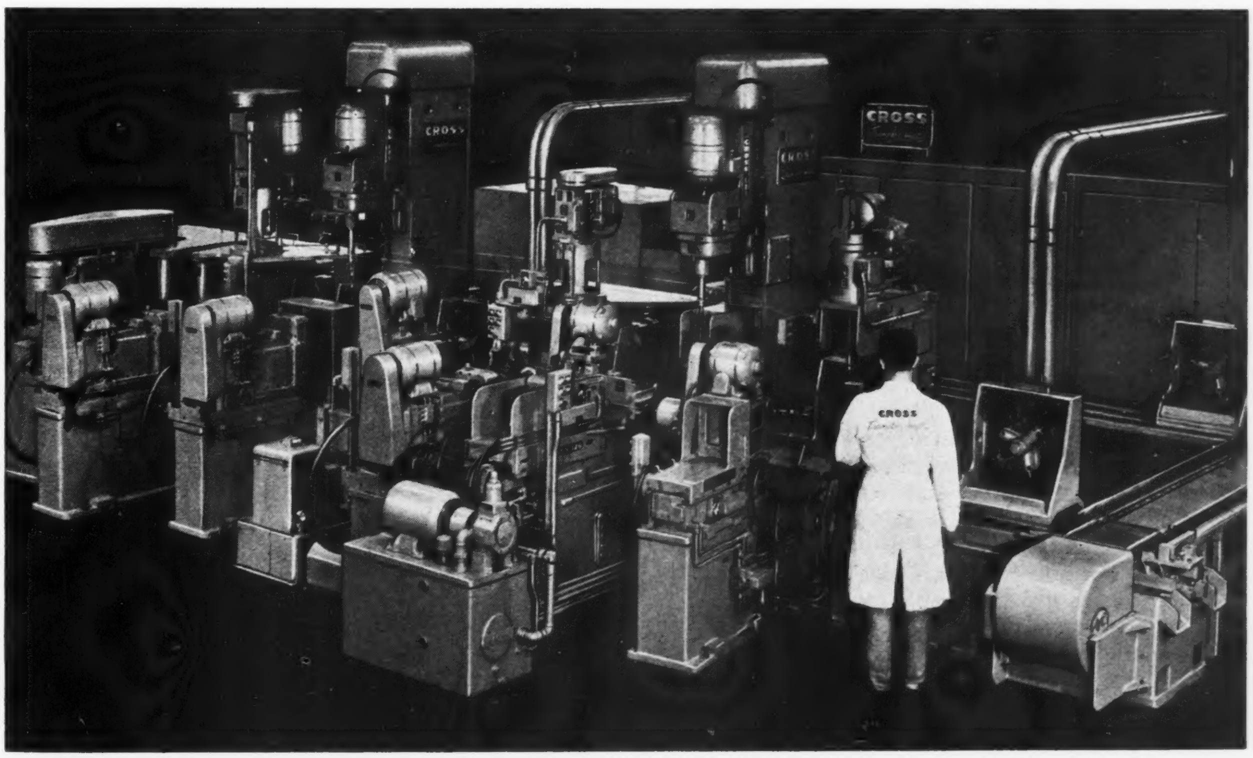
possible damage to personnel and equipment. Another improvement is the increased height of the belt cover. This provides greater capacity and permits a freer flow of scrap materials.

The "Chip-Tote" unit can be furnished in sizes to fit practically all machine tools, standard or special, and its speed of operation can be synchronized with the metal-removing capacity, as well as the rate of coolant flow, of the machine to which it is attached. Scrap material is funneled onto the conveyor belt by a hopper, carried horizontally until clear of the working mechanism of the machine, and then transported up a 60-degree incline for discharge into tote boxes or onto a conveyor. The special May-Fran hinged-steel conveyor belting has an overlapping wing design which confines the scrap while carrying it to discharge points. Perforated steel links can be supplied for applications in which complete drainage of coolant from chips is necessary. 66

Special "Transfer-matic" for Machining Clutch Housings

Several unusual features are incorporated in a new special "Transfer-matic" recently built by The Cross Company, Detroit, Mich., for milling, drilling, boring, reaming, chamfering, and tapping clutch housings at a production rate of ninety-four pieces per hour. Only two unskilled operators are required for this machine—one to load and press the starting button, and the other to unload the completed housings.

This machine, like all "Transfer-matics," is equipped with automatic transfer mechanisms that move the work from station to station. Palletized fixtures hold the work-pieces while they are being transferred from one end of the machine to the other. An integral conveyor automatically returns the pallets from the



Special "Transfer-matic" built by The Cross Company for machining clutch housings

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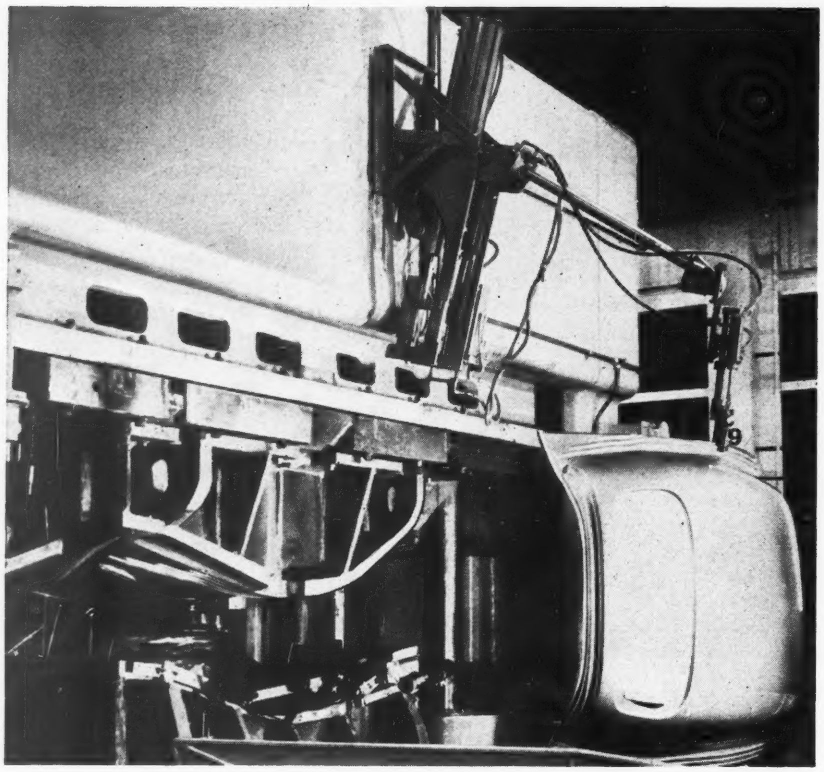


Fig. 1. Sahlin "Iron Hand" used to lift 75-pound automobile roof stamping out of press

unloading to the loading station. The work is done at nine stations—one for loading, seven for cutting, and one for unloading. Chips are automatically removed by a built-in conveyor. 67

New Steel Jaws Increase Handling Range of Sahlin "Iron Hands"

The Sahlin Engineering Co., Birmingham, Mich., has announced the development of six metal jaws for use with its "Iron Hands." The new jaws are designed to accommodate various die and lift conditions encountered in the automatic unloading of stamping presses. The gripping jaws or members supplied with three models of the Sahlin "Iron Hand" have been developed to replace manpower on operations where manual unloading is slow, dangerous, and costly. The new steel jaws shown in Fig. 2 are also used on special material-handling devices.

The vise- and chisel-type jaws are the two basic designs, applicable to 75 per cent of the press unloading jobs. The vise type will grip parts raised 2 inches or more above the die surface, while the chisel type will dig under a part resting on the die.

Recently, precision clamping with these jaws was perfected with new vise- and cone-type grippers. Specialty jaws for gripping unusual stamping work include a hook type for application where a gripping edge is lacking; a Neoprene-tipped grip to protect parts with special finishes; a pivot type that swivels laterally to clear tight die areas; and a confined type which locks parts having a vertical flange without damaging the edges.

The "Iron Hand" can be equipped to pick up a 1-ounce coin or a 100-pound freight car section. Several are used to unload 75-pound automobile roofs, as shown in Fig. 1, at the maximum speed of six or seven per minute. 68

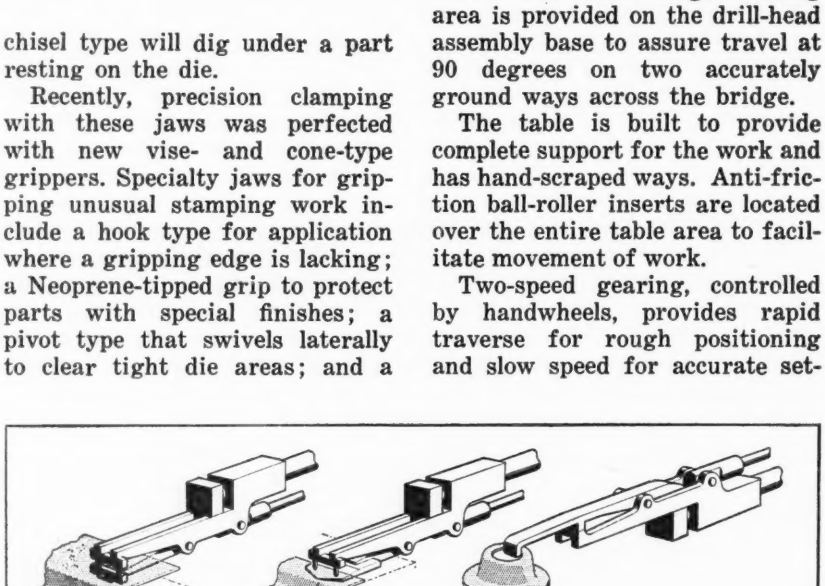


Fig. 2. Six new types of metal jaws developed for use on Sahlin "Iron Hand"

Wales Drilling Machine for Precision Lay-Out, Drilling, and Reaming

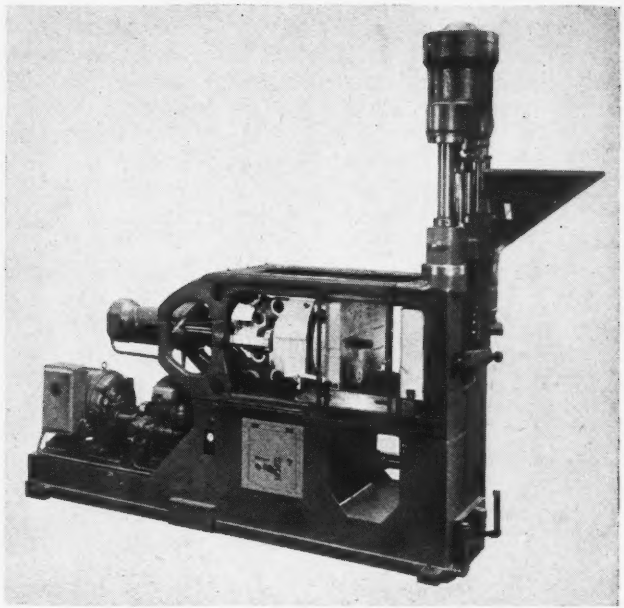
The Wales-Strippit Corporation, North Tonawanda, N. Y., has designed a new machine for precision lay-out, drilling, and reaming work. This machine is designed to handle sheets of practically any length and up to 36 inches in width. The precision built drill head has anti-friction bearings, a guide support which is adjustable vertically to position the drill, and a reamer guide bushing near the top of the work to insure maintaining close tolerances. An extra large bearing area is provided on the drill-head assembly base to assure travel at 90 degrees on two accurately ground ways across the bridge.

The table is built to provide complete support for the work and has hand-scraped ways. Anti-friction ball-roller inserts are located over the entire table area to facilitate movement of work.

Two-speed gearing, controlled by handwheels, provides rapid traverse for rough positioning and slow speed for accurate set-

To obtain additional information on equipment described here, use Inquiry Card on page 229.

Drilling machine developed by Wales-Strippit Corporation for precision lay-out work



Injection molding machine of improved design brought out by Lester-Phoenix, Inc.

ting when locating the drill head on the bridge. Built-in scales, with 1/32-inch graduations are conveniently located for easy reading and permit rough locating of the drill head and slide-rail. For accurate setting, dial indicators calibrated in ten-thousandths inch are used in conjunction with end measuring rods placed in V-grooves. Air clamp levers rigidly lock both drill head and slide-rail in exact zero positions.

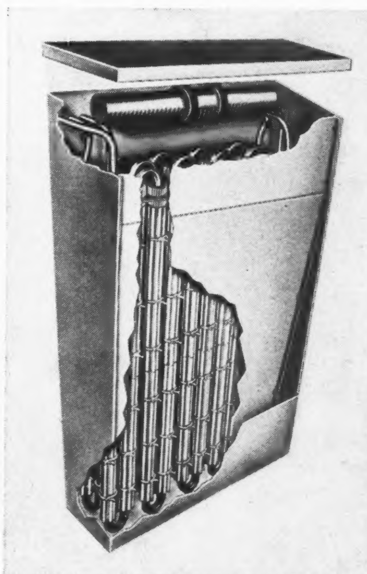
Two sets of steel drawers are conveniently located in the base for holding drills, reamers, and other accessories. Eight leveling screws on the bottom of base permit adjustment to compensate for uneven floors. 69

Williams Oil Cooler

The "Will-Cool" oil cooler just announced by the B. S. Williams Co., Inc., Mount Vernon, N. Y., has been developed to maintain the cutting oil of machine tools at a predetermined temperature throughout the year. Coolers can also be supplied with equipment designed to keep lubricating oil and hydraulic oil at the required temperatures simultaneously. The lubricating and hydraulic oils are not exposed to the atmosphere while being cooled.

It is claimed that this new oil cooler provides the following advantages: Increased capacity; uniform work-pieces; uniform oil viscosity; longer tool life; less tool grinding; less adjusting time on machines; cooler work-pieces, which are easier to handle and gage; and reduction of oil evaporation. The cooler is easy to clean and service, and is so designed that the inside cooling surface can be cleaned by maintenance men without disconnecting refrigerant lines or oil lines.

All oils within the viscosity range of those used for machine tools can be handled. Thus different oils can be selected, if desired, without affecting the operation of the cooler. 70



Williams cooler developed to maintain cutting, lubricating, and hydraulic oils at uniform temperature

Lester-Phoenix Improved Injection Molding Machine

A new 8-ounce injection molding machine, known as "L-2-8," has been developed by Lester-Phoenix, Inc., Cleveland, Ohio. This machine combines the advantages of the quick-acting die-locking linkage of the smaller machines with the more efficient recently designed injection cylinders. The plasticizing capacity has been increased by 20 per cent and hydraulic lines have been simplified and relocated outside of the base.

This machine will mold 8 ounces of polystyrene or 10 ounces of acetate with a plunger displacement of 32 cubic inches. When the four pyrometers are set for a temperature of 600 degrees F., the machine will deliver an hourly output of 80 pounds of polystyrene heated to 400 degrees F. The improved internally heated injection cylinder enables the machine to produce a 6-ounce polystyrene bowl at 100 degrees lower molding temperature and a reduction in cycle time from twenty-eight seconds to twenty-three seconds, as compared with the production cycle of the older 8-ounce equipment.

The large die-plates, 22 1/8 by 28 inches, will accommodate the standard 18- by 23 1/2-inch DME mold base. The stationary die platen is made in such a way that a locating ring of any dimension

To obtain additional information on equipment described here, use Inquiry Card on page 229.